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THE STAINING OF HUMAN ENAMEL IN BULK*

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BECAUSE of its almost wholly inorganic character, and its great power of absorbing, refracting and reflecting light, the enamel is probably the most difficult tissue in the body to study histologically. Its inorganic nature precludes the usual methods of histologic preparation; and considerable experience is necessary to secure sections maintaining the integrity of the whole specimen and withal thin enough to permit accurate microscopic examination. This is especially true of cross-sections, which are so rich in information and which have heretofore been slighted by the conventional technic. Normal enamel *per se* is unstainable with the anilin dyes, but they will penetrate and collect in spaces within its structure. Metallic salts will impregnate enamel surfaces to a slight depth and collect in structural interstices. Staining in section is, therefore, largely inapplicable and without value, except in an auxiliary way.

Much information on the histologic character of this unique tissue, as well as the occurrence of structural aberrations, and on its histopathologic nature, accrues from subjecting teeth to various stains before sectioning. This method also is of much interest because the manner in which the stains penetrate in bulk may indicate avenues of permeability of the tissue to nutrient fluids; or, theoretically, a possible organic content in this hard tissue may thus be demonstrated. It is not the purpose of this paper to bolster up any theory of

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histologic structure, or possibility of metabolism of the enamel; but merely to present sections showing various areas into which certain stains have penetrated *en masse*.

The method employed has been simple. The best results have been obtained from the use of freshly extracted teeth, eliminating solution of formaldehyd from the technic entirely, passing them through graduated solutions of alcohol, and then immersing them in one of the following stains: 2 per cent alcoholic solution; basic fuchsin, gentian violet or equal parts of crystal violet and brilliant green; or a 10 per cent aqueous solution of chemically pure silver nitrate. The roots of the teeth were cut off to permit free entrance of the solutions into the pulp chamber, and the solutions diffused through the dental tissues. Resection of the root also obviates a high liability of the microscopic sections to longitudinal fracture. Experience with this method indicates that it is unnecessary to resort to high-pressure injection of the solutions; and, furthermore, diffusion more nearly simulates any possible physiologic passage of fluids into the deeper structures. A varnish of celloidin was used on the exterior of the enamel in certain cases to prevent the tooth from being subjected to stains from both surfaces. After the teeth had been in the staining solutions for varying periods of time, some were bisected longitudinally, and others cut in cross-section blocks, and then ground to approximately 10 microns on Black's microlethofer, under either water or paraffin oil. Our greatest difficulty was encountered in preventing decoloration of the blocks during mounting, grinding and demounting.

Fig. 1.—Enamel cuticle, Nasmyth's membrane, in situ on lingual surface of upper incisor. Grinding and mounting have ruptured the cuticle.

The staining of enamel in bulk is properly considered under two divisions: permeability to staining solutions from the free surface inward, and the penetration of stains from the pulp chamber through the dentin and across the amelodentinal junction into the enamel.

When the free surface of enamel is subjected to stains by immersing the whole tooth in staining solutions, several developmental and acquired pathologic areas of the enamel leading from the periphery inward prove to be per-

meable to the stains. The greater part of intact, normal enamel is not permeable to stains. However, enamel is not always a perfect tissue, true to type, but exhibits a wide variability of structure. Imperfections and channels may abound. Any gross or microscopic interstices leading from the periphery inward will be permeated by the stains; but this action will be greatly impeded or prevented if the surface is covered with the enamel cuticle or Nasmyth's membrane. Anterior teeth do not admit the stains so readily as do posterior teeth, as the structure of the former is more compact than that of the latter, for the most part. In the following tissue conditions, there was penetration from the periphery by the stains used: (*a*) macroscopic and microscopic hypoplastic defects, including pits, fissures or faults; (*b*) fracture lines, bruised areas, or any part of the enamel cap affected by physical trauma; (*c*) areas which have been partially decalcified with fixing, staining or other laboratory reagents, in particular solutions of formaldehyd and of crude silver ni-

Fig. 2.—Deep narrow fault in occlusal surface of molar. Stain has penetrated both from the outside and through the dentin into this fissure.

trate; (*d*) carious enamel, that is, partially decalcified areas ramified by the presence of many interstices between the rods as well as by partial disintegration of the rods, in which state there is a clearly differentiated pericolumnar sheath; (*e*) mottled enamel, or incompletely calcified enamel of any type. Teeth stained *en masse*, particularly if the enamel cuticle is not intact, may exhibit penetration of the stain in any of the foregoing instances in various parts of the enamel; and, in addition to these conditions, there must be added

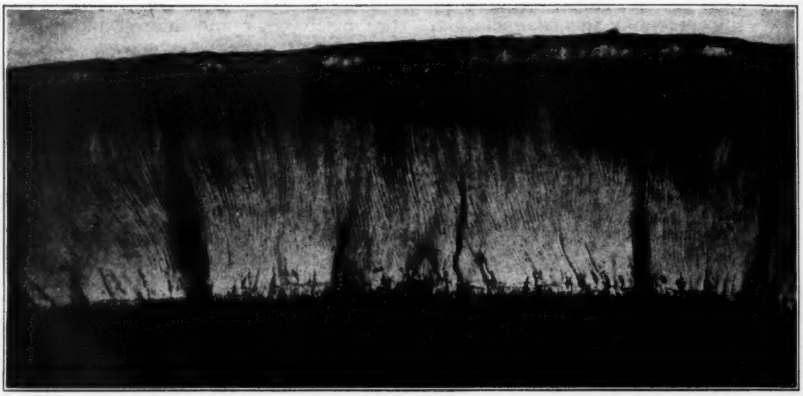

Fig. 3.—Cross-section of molar near the cervical border of the enamel. Simple tubuli, ampullae and fracture lines have been penetrated by the stain from the dentin, and stain has penetrated the fracture lines from the periphery.

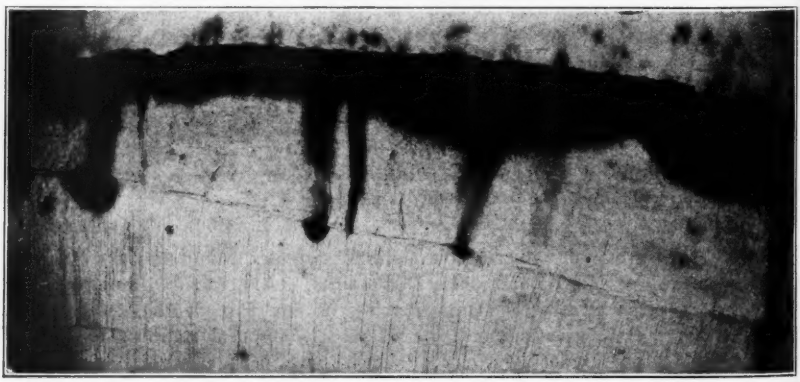

Fig. 4.—Cross-section of molar near the cervical border of enamel from a tooth that had been stained before sectioning with silver nitrate. The solution has passed through fracture lines from the outside to the dentin.

the possibility of smearing metallic stains in grinding over areas that were entirely unstained before sectioning. Caution is necessary to prevent affecting the integrity of the highly calcific enamel by acid reagents, and in detecting and ruling out surface deposits of stains. The latter statement is particularly pertinent to the use of silver nitrate; and, it should be mentioned, false doctrines have been published because of misinterpretations in this connection.

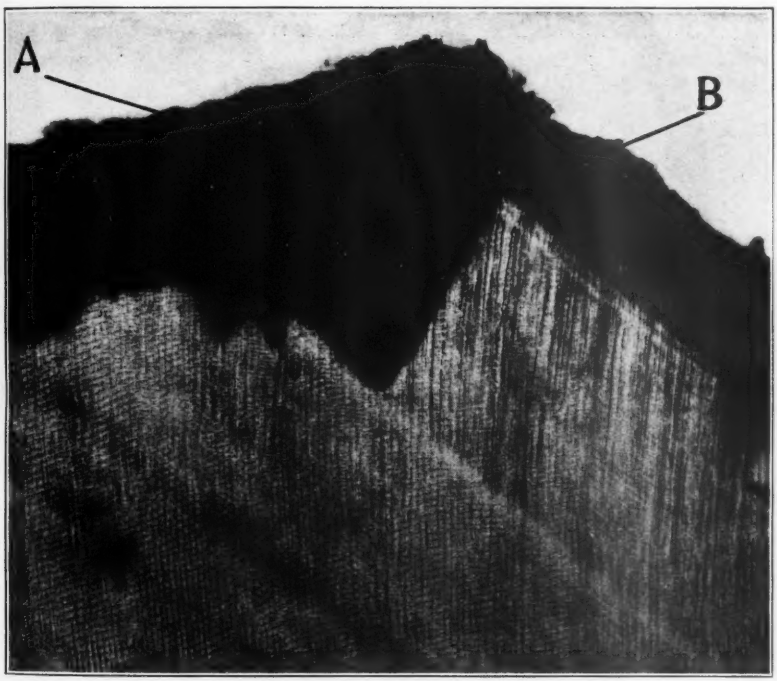

Fig. 5.—Section of tooth stained with silver nitrate. Area marked *A* was mutilated with a corundum wheel before sectioning; surface marked *B* was undisturbed.

In the presence of the following structural elements and tissue conditions, there was permeability to stains from the dentinal surface; that is, when the root was resectioned, the staining solutions were freely admitted to the pulp chamber, and diffused rapidly through the dentinal tubuli and across the amelodentinal junction into the enamel: (*a*) simple dentinal tubuli that extend across the border a short distance and usually terminate between the rods; (*b*) enamel spindles, probably better described as ampullae, or culs-de-sac, into which dentinal fibrils pass, or which may really be terminal enlargements of the dentinal tubuli in the enamel, and which appear constantly near the apices of dentin cusps and also

near the cervical border, as observed in cross-sections; (*c*) irregular brushlike areas with short stems at the junction, a central space; (*d*) areas of granular rods in which the formative elements, the globular calcospherites, have not

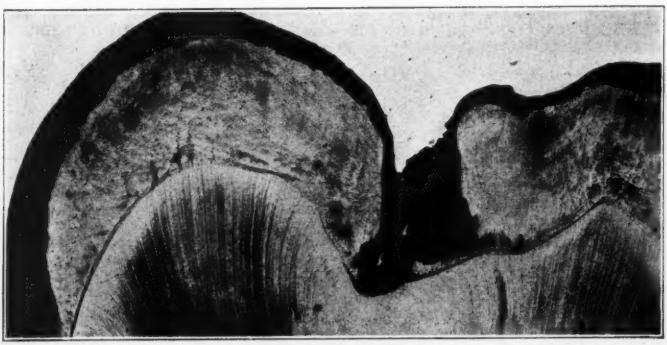

Fig. 6.—Enamel superficially affected with acid reagents, with an even penetration of the stain resulting, except in the carious pit.

which may be called tufts, but structurally are probably spiral arrangements of loosely cemented enamel rods with been completely calcified; (*e*) frank hypoplastic areas or anomalous cavities, some of which may extend from the

Fig. 7.—Mesiodistal section of bicuspid stained in bulk with silver nitrate. Ingress of the stain indicates partial decalcification through caries.

periphery of the enamel to the dentin, sometimes in the form of channels loosely filled with amorphous calcific material; (*f*) fracture lines; (*g*) carious enamel.

Most of the foregoing conditions doubtless involve physical spaces or intercolumnar interstices of various sizes, some of which in the fresh or living condition possibly are filled with fluid, though this is problematic. Deposition

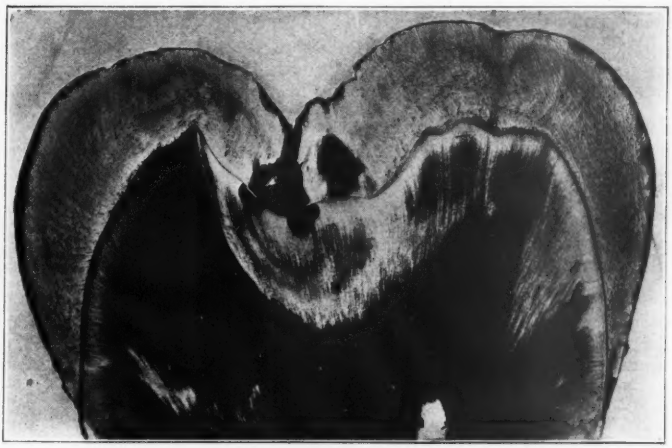

Fig. 8.—Buccolingual section of a molar that has been stained in bulk with fuchsin. The carious enamel pit is penetrated by the stain, but the subjacent translucent zone is not permeable.

of any kind of staining agent in these spaces is not conclusive of organic content. The evidence indicates that they are physical spaces. Fuchsin and other stains will readily collect in spaces. These tissue conditions were brought about by incomplete calcification developmentally; or later, through environment, by partial decalcification of the enamel. Since there are no cells in human enamel, requirements for and existence of metabolism in this nonregenerating, nonreacting tissue are highly improbable. As has been set forth by Professor Hopewell-Smith, the enamel in all probability is a dead, inert, fully formed tissue, because of the circumstances of its histogenesis and since it reacts to none of the biologic tests. This statement as to nature of this unique tissue is not accepted in many quarters, probably because of the conventional comparison of dental tissues as a whole to bone; but it should be borne in mind that enamel, histogenetically, histologically, physiologically, and pathologically, bears a greater similarity to stratified epithelium than to bone. Histologic examination, aided markedly by the method of staining herein described, has revealed no evidence that adult, erupted enamel undergoes further calcific consolidation: newly erupted teeth are no more permeable to stains in bulk than are teeth that have been exposed to the oral environment for years.

Ingress of stain from the periphery is illustrated in Figures 1 to 10. In the photomicrographs, the dark portions usually correspond to the stained portions in the microscopic slides. The camera lucida drawings were made in colors corresponding to the stains. In other photomicrographs the stained areas were painted in. Attention is called to the contrast of enamel structure as seen in longitudinal and cross-sections.

Figure 1 shows the enamel cuticle in situ, a break having been produced by pressure on the cover slip in mounting, with one end of a segment separated from the enamel. This tooth, which was stained with gentian violet, shows no penetration of the stain through the cuticle into the normal well-formed enamel. The cuticle is tenaceously held to the enamel, and remains on surfaces not exposed to wear or operative interference throughout life.

Figure 2 shows a deep fissure on the occlusal surface of a molar that was subjected to fuchsin. The stain has penetrated from the periphery to the amelodentinal junction and fused with the stain coming from the interior through the dentinal tubuli. This is an example of a deep occlusal fissure, so well known to the profession. The hypoplastic defect in this instance is in the form of a narrow channel, which is occupied by an invagination of the enamel cuticle, the two layers being together in this fissure. In the study of a large number of ground sections of enamel, it has been constantly observed that the enamel cuticle is most closely adapted to all surface irregularities and is invaginated in every pit and fissure. The presence of a double layer of this cuticle in the fissures, between the different lobes of the enamel cap, appears to have prevented fusion in many instances of these units. This observation is, I believe, original. It would seem that the genetic organ came to be in its own way and thus prevented union of the lobes produced by different amelification centers, and left a double layer of its atrophied remnant in situ. When the fissure is wider, the channel on the outside of the cuticle is frequently filled with an amorphous calcific deposit,

Fig. 9.—High magnification of carious enamel with bacterial plaque in situ, stained with gentian violet. Attention is called to a pericolumnar sheath, which is differentiated both from the rods and intercolumnar interstices.

sometimes erroneously referred to as coronal cementum.

Figure 3 is a reproduction of a cross-section of a molar near the cervical border of the enamel. The tooth had been subjected to 2 per cent alcoholic solution of basic fuchsin previous to sectioning. It will be noted that the stain has penetrated from the exterior through four well-defined narrow spaces leading from the periphery to the dentin at right angles to the surface. The stain passed also from the dentin into these spaces. The nature of these clefts, which constantly appear in cross-section even of teeth chosen because of the macroscopic soundness of their enamel, has been controversial. C. F. Bodecker[1] has made a special study of these lines, using a decalcification-in-celloidin process. He apparently considers them organic in nature and refers to the lines as enamel lamellae. A tough film marks their position after the surrounding enamel has been decalcified. Some sections appear to indicate that they are continuous with the enamel cuticle. Two other explanations of these lines may be offered: (1) many of them may be merely fracture lines, or (2) they may represent an incomplete degree of calcification of the intercolumnar cement substance in the center of a group of spirally arranged enamel rods. In either of the two latter conditions, extraneous material from the oral cavity, celloidin, during the embedding process, and stains readily and rapidly penetrate. Reference to Figure 3 will again be

Fig. 10.—Bicuspid stained in bulk with fuchsin. From the exterior, the stain has penetrated carious enamel on one approximal surface and slightly in the occlusal fissure. From the dentin, it has penetrated into many ampullae.

1. Bodecker, C. F.: Permeability of the Enamel in Relation to Stains, J.A.D.A., 10: 60 (Jan.) 1923.

made in considering penetration of the stain from the dentinal surface.

Figure 4 is a photomicrograph of a cross-section of a molar similar to the preceding one but stained only from the exterior with silver nitrate. The penetration of the stain through these vertical clefts from the exterior to the dentin is plainly seen. In the dentin near the amelodentinal junction, the stain has spread out into mushroom-shaped areas.

Not only may the enamel be checked in lines, but also a whole area may be bruised by some form of traumatism. A bruised area will readily admit stains. Figure 5 is a section of enamel showing the effect of mutilating a surface with a corundum wheel. The surface showing the deeper penetration at *A* was mutilated prior to immersing the tooth; and the area in which the penetration is practically nil at *B* was covered by the enamel cuticle and surface film and not disturbed. A critical examination of this latter area under the microscope shows that the stain had not penetrated the enamel at all, but the diffuse dark areas have been produced by smearing the silver deposit over the surface of the section in grinding. The deep penetration of the stain on the other area was brought about by the removal of the protective cuticle and the shattering of

Fig. 11.—Unstained section of molar showing many ampullae surrounding a dentin cusp.

the outer ends of the enamel rods by the corundum wheel.

Figure 6 is a section of tooth that had been subjected for some time not only to acid-reacting solution of formaldehyd (U.S.P.) but also, subsequently, to crude acid-reacting silver nitrate. Superficial partial decalcification is brought about which permits fairly uniform penetration of the staining agents from the periphery, with deeper staining of a carious fissure.

Figures 7 to 10, inclusive, exemplify the penetration of stains from the periphery into carious enamel, and incidentally into dentin in some instances. Figure 7 is a mesiodistal section of a bicuspid subjected to silver nitrate. This section is instructive in several respects. First, it will be noted that over

Fig. 12.—High magnification of a small field from Figure 11. The minute character of the dentinal tubuli, enamel rods and ampullae is shown.

an extensive area, including the occlusal two-thirds of one approximal surface and, for the most part, the occlusal surface, the stain has not penetrated. These areas are composed of normal, well-formed, intact enamel, led near or to the dentin, and thus permitted the ingress of the stain into the outer part of the dentin, as shown in this section. Thus, this isolated stained area of dentin with no apparent surface connection is explained. The reaction

Fig. 13.—Section of tooth stained in bulk with fuchsin. The stain has passed from the tubuli into the ampullae, which have been stained fully and evenly, and from them has diffused into the surrounding enamel slightly.

which has not been affected by the oral or laboratory environment. The cervical one-third of the approximal surface just referred to has been penetrated by the stain but shows no break in its surface contour. This area was in the outer margin of a carious lesion. In a portion of the tooth not included in this section, an open carious cavity of the pulp, as expressed in the band of sclerotic dentin, subjacent to the invading lesion, is beautifully shown in this section. This reaction in the dentin is well known as the "translucent zone" of Tomes or Miller. The other approximal surface had been exclusively and deeply affected by the carious process, really a partial decalcification in

which many interstices are produced between the rods, and this enables deep penetration of the stain over a large area without, as yet, any break in the enamel contour. About the cervical border, the stain has penetrated completely through the enamel.

Figure 8 is a buccolingual section of a molar that had been subjected to fuchsin both on the exterior and through the pulp chamber before sectioning. The stain has penetrated freely into carious enamel about an occlusal fissure. There is but little penetration of the stain from the periphery at any other place. Near the site of the stained fissure is an isolated area of stained enamel, which was brought about by undermining caries. The stain has also penetrated the carious dentin subjacent to the carious enamel fissure. The consolidated or sclerotic nature of the translucent zone intervening between the lesion and the normal dentin is such that the stain has penetrated it but little from the pulp chamber. The staining of this carious tooth has differentiated well the translucent zone from the normal dentin surrounding it.

Figure 9 is a high magnification of a section of carious enamel stained with gentian violet. In situ on the periphery is a heavy feltlike mass of bacteria, or bacterial plaque. The technic required in securing the bacterial plaque in situ on ground sections is such that there apparently are few in existence. At least, other than the sections published by Leon Williams many years ago and frequently used by other writers, and the ones prepared by myself, none have come under my observation although a careful search of the literature has been made. The enamel subjacent to the bacteria is decalcified to a considerable degree, with the result that many interstices have developed between the enamel rods, as well as a partial disintegration of the rods taking place. It is believed that this specimen brings out

Fig. 14.—Section of bicuspid stained in bulk with fuchsin, which has not only penetrated many discrete ampullae but also several tufts, which are areas of dispersion of the rods.

a feature that has not been illustrated heretofore in dental literature; namely, a pericolumnar line in connection with each rod which is differentiated from both rod and intercolumnar substance. This line showing in section represents, by caries and through staining, becomes differentiated. In the carious sections, there is a space both between it and the rod it bounds, and between it and its neighboring line, between which the intercolumnar substance has been dis-

Fig. 15.—Section showing exceptionally long whorls or tufts.

of course, a complete sheath about the rods. A reproduction of this section, with attention directed to this pericolumnar sheath, was published in 1924.[2] This sheath probably represents an organic stroma that becomes calcified during the formation of the enamel; and then, subsequent to decalcification solved out. It would thus appear that the pericolumnar sheath is probably the the most resistant part of the enamel structure to the acids of caries. From this and previous sections, it will readily be seen that enamel may be partially decalcified through its entire thickness without a breach occurring in its external contour. This skeletonized form will eventually break down.

2. Leigh, R. W.: Internat. Clin., 3: 6-28 (Sept.) 1924.

Figure 10 is a section of a bicuspid that has been immersed in fuchsin. The stain has penetrated a carious area on one approximal surface. The partial decalcification has varied within this area, the destruction being greater where the stain is more intense. There is beginning caries about the occlusal fissure, which also is penetrated slightly by the stain.

Fig. 16.—The stems of the tufts are prominent; the intercolumnar spaces are well defined.

Penetration of stains from the dentinal surface is exemplified in Figures 11-20 as well as in Figures 2, 3 and 10. In Figure 3, the stain has penetrated the dentinal tubuli to their extremities, many of their terminals being in the enamel. There is a characteristic dichotomous branching of the tubuli near the junction, and some of the tubuli pass the amelodentinal junction for short distances into the enamel and end blindly with an abrupt tapering. These simple tubuli in the enamel are usually located between enamel rods. To the casual observer, many more of these simple tubuli appear to pass into the enamel than really do so. The surface of the enamel facing the dentin is composed of innumerable small convexities. Because of the necessary thickness of the sections, several of these convexities may be superimposed, and ends of tubuli that apparently are within the enamel are really in the dentin between the convex projections.

Surrounding the apices of dentin cusps, and also in the region of the cervical border, are many spindle-

shaped blind-ending culs-de-sac or ampullae. These bodies have been observed by many histologists, but their true nature has never been satisfactorily demonstrated. They are much longer, larger and more irregular than the simple dentinal endings above referred to. They lie tangentially to the rods and often appear to contain a granular or beaded content. These granules are referred to as Römer's corpuscles. Figure 11 is an unstained section showing diffuses out from them somewhat into the surrounding enamel. Their communication with the dentin is evidenced by the passage of the stain from the fibrils into their interior. Douglas Caush[3] was the first investigator to demonstrate clearly the staining of these ampullae. John S. Marshall, W. G. Skillen[4] and others have since studied these bodies extensively through staining methods. With reference to their location, Otto Walkhoff[5] states: "At

Fig. 17.—Stain penetration into a cleft that extends from the base of the fissure to the dentin, also into two large anomalous cavities within the enamel, which are not carious.

many of these ampullae surrounding the dentin cusp of a molar. Figure 12, a high magnification of a small part of Figure 11, shows quite plainly the character of the ampullae and the relation to both enamel and dentin. Apparently, dentinal fibrils pass into them, or they may be interpreted as terminal dilatations of the dentinal tubuli within the enamel. The terminal two-thirds of one of these bodies, it will be noted, is clear and transparent. In Figure 13, a section of tooth stained with fuchsin in bulk, the ampullae have all taken a clear uniform coloration. The stain

the apex of a dentinal cusp the club-shaped processes ending in the enamel are for the most part present, *but are totally lacking at the cervix of the tooth.*" This statement was probably arrived at through study of longitudinal sections only, as in cross-sections innumerable ampullae are to be observed near

3. Caush, D. E.: Tr. Internat. Dent. Cong., 1904, p. 170.

4. Skillen, W. G.: Permeability of Enamel in Relation to Stains, J.A.D.A., 11: 402 (May) 1924.

5. Walkhoff, Otto: Dent. Cosmos, 65: 176, 1923.

the cervix. Figure 3 shows ampullae near the cervical border. Because of their very definite structure and constant occurrence in the locations indicated, the ampullae must be considered normal histologic entities within the enamel, and they are readily permeable to stains in bulk.

Figure 14 shows another structural condition of the enamel that has been observed by several dental histologists but has been confused by some with the ampullae above described. This section shows several brushlike diffusely stained areas with a constricted stem at the junction. The word tuft has been applied to these areas because of their similarity to a bunch of grass or brush; but it would appear that they represent structurally a spiral arrangement of enamel rods in which the intercolumnar cement substance is poorly calcified and thus permits the ingress of stains from the dentin. These bodies, which have been referred to as whorls, may no doubt, because of their constancy, be properly considered normal enamel formations. The spiral apparently is hollow or is loosely constructed in its center. These whorls,[6] which are observed in both longitudinal sections and cross-sections, readily and rapidly admit the stains. Figure 2 shows a continuous band of whorls or tufts near the junction on either side of the occlusal fissure. In Figure 15, the whorls are long and undulating. Figure 16 shows the stems of the tufts and the prominence of the intercolumnar spaces into which the stain has penetrated.

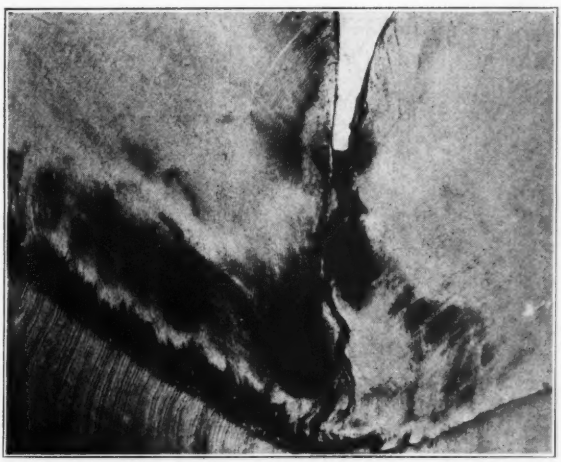

Fig. 18.—High magnification of the central fissure in Figure 17. A band of tufts on the left of the fissure is heavily penetrated by the stain.

Enamel spindles or ampullae and the brushlike areas, or tufts, are not identical as is claimed by Beust. In Figure 14, both tufts and the much shorter

6. Mummery, J. H.: Structure of Teeth in Relation to Dental Diseases (Report of the Committee for the Investigation of the Causes of Dental Disease), London, 1922.

ampullae are sharply differentiated. The ampulla is a small discrete element; while the tufts are large areas in which the calcification of the intercolumnar substance is poor. The ampullae are rarely as long as the usual tufts. Discrete spindles or ampullae may be observed within tufts. In any given area, the ampullae generally run parallel to each other, practically always tangentially to the rods, at acute angles to the tufts, and approximately at right angles to the amelodentinal junction. The tufts always run with the rods. In cross-sections, near the cervix, innumerable ampullae may often be observed, as well as long narrow tufts or spirally arranged dispersions of the rods. Spindles or ampullae are really terminal dilatations, culs-de-sac, of dentinal fibrils within the enamel; while tufts are aggregations of intercolumnar interstices either partially or entirely lacking in intercolumnar cement substance. The character of the tufts, other than a spiral arrangement of the rods, may be accounted for by a lateral developmental spreading of the crown, that prevents complete calcification of the intercolumnar substance. The intercolumnar substance thus varies in degree of calcification. It is probable that both ampullae and whorls or tufts are of vestigial significance, being homologous to the spaces in tubular enamel of lower organisms.

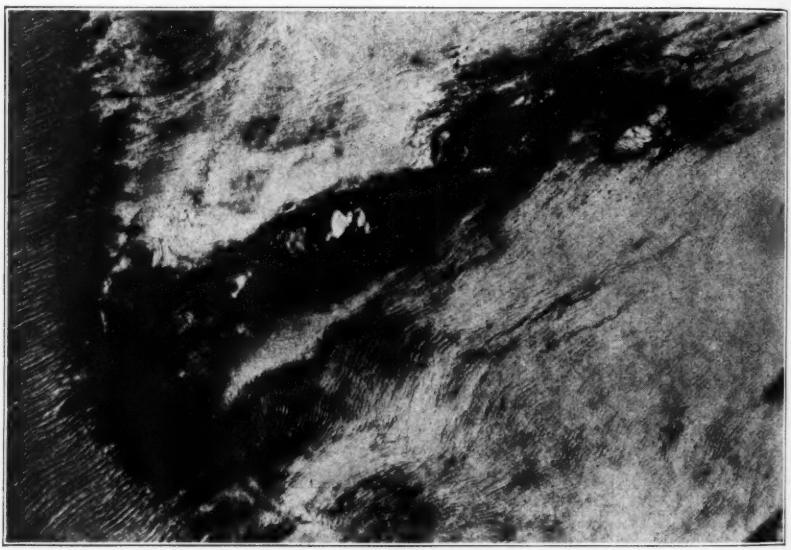

Fig. 19.—High magnification of the anomalous cavity on the right of Figure 17.

Occasionally, there are areas of enamel in which not only is the intercolumnar cement substance poorly calcified, but also the calcification of the rods themselves is not consolidated and stains permeate throughout the area. It would appear that the formative elements or calcospherites have failed to

coalesce. In Figure 16, there is such an area of granular rods.

Frequently, an open channel or a cleft leads from the bottom of an occlusal fissure to the dentin, and stains readily penetrate from the dentin into such openings. Figures 2 and 17 show these clefts, stained from within. In addition to the openings at the bottom of occlusal fissures, not infrequently frank hypoplastic areas or anomalous cavities are located sufficiently near the amelodentinal junction to permit stains to penetrate into them from the tubuli. Figure 17 shows two such cavities, of macroscopic size. Figure 18 is a high power photomicrograph of the central fissure in Figure 17. In addition to the open fissure and cleft leading therefrom to the dentin, a continuous band of tufts is to be noted on the left extending from the amelodentinal junction for a short distance into the enamel. Figure 19 is a high power photomicrograph of the anomalous cavity on the right side of Figure 17. Besides the large cavity into which the stain has profusely passed, there will also be noted on

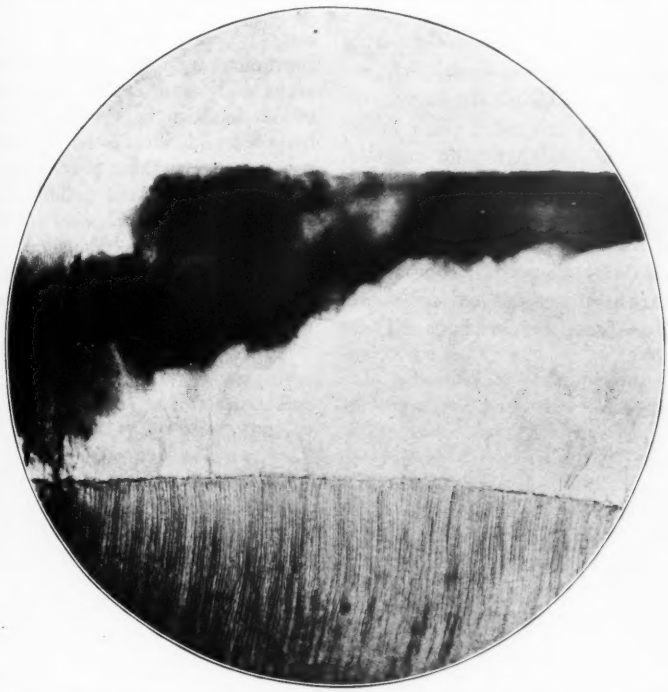

Fig. 20.—Cross-section showing approximal surface of molar, stained with brilliant green and crystal violet. Old fracture line extends into dentin. Stain from dentin extended into apex of carious enamel.

either side of it stained ampullae and whorls.

Figures 3, 17 and 20 show fracture lines extending to the dentin. Various fracture lines exist in the enamel of most teeth. They admit stains readily, both from the periphery and from the dentin.

In cases of rapid caries, the partial decalcification of the enamel may extend to the amelodentinal junction before eburnation has taken place in the dentin, as a result of pulp reaction. Such a carious area will be diffusely stained from the dentinal tubuli. Figure 20 is a cross-section showing a large area of carious enamel into which the stains have passed from the dentin as well as from the periphery. There is an old fracture line with subjacent translucent zone in the dentin.

SUMMARY

There are five general conditions of the outer part of the enamel in which there are macroscopic or microscopic interstices that are permeable to stains in bulk. There are three well identified histologic elements in the enamel continuous with the dentinal tubuli that are readily and rapidly penetrated by stains that diffuse through the dentin in bulk; and, in addition to these constant elements, there are several developmental or acquired pathologic conditions of the enamel seen in the area bordering the amelodentinal junction into which stains pass from the dentin. An organic content of the enamel has not been established.

A STUDY OF TRAUMATIC OCCLUSION FROM THE ORTHODONTIC POINT OF VIEW

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TRAUMATIC occlusion holds the attention of the dental profession today. It is paramount in popular interest. State societies have heard much about it and many men are accepting the beliefs of enthusiasts as if they were facts. The extraordinary significance that the periodontist has attached to the condition he calls traumatic occlusion challenges the attention of every department of dentistry. The idea of grinding the occlusal surfaces of the teeth and thereby preventing or curing, in its incipient stages, one of the most serious of the dental diseases is a scheme so simple and alluring that the general application of it now being given should be subjected to thorough criticism.

Criticism is the life of science; it is one of the safeguards of progress. Pearson says,[1] "One of the most fatal (and not so impossible) futures for science would be the institution of a scientific hierarchy which would brand as heretical all doubt as to its conclusions, all criticism of its results . . . . It can scarcely be questioned that when the truth or falsehood of an event or observation may have important bearings on conduct, overdoubt is socially more valuable than overcredulity." The dental profession is not notable for its tolerance of criticism. The questioning of a man's belief as to certain methods of practice has often given rise to personal antagonism most regrettable. During this discussion, differences of opinion will be expressed, conclusions will be questioned; but if it is done in the right spirit of skepticism, much good will come out of it.

It is quite within the bounds of reason to believe that the prevailing notion of traumatic occlusion has its foundation in one of the earlier misconceptions of orthodontia. The ideal scheme of occlusal relations of the cusps of the teeth conceived by Angle[2] and characterized by him as normal occlusion is, I believe, the basis upon which the idea of traumatic occlusion has been built. Because of this and the fact that traumatic occlusion is essentially a question of adaptation, it seems reasonable that the orthodontist should take part in this discussion. I shall, first, give what I think to be the scientific basis for the idea of traumatic occlusion; second, review the problem of normal occlusion; third, emphasize the necessity of a consideration of the natural adaptive processes of periodontal structures before mutilating the tooth surfaces by grinding.

1. Pearson, Karl: The Grammar of Science, London, pp. 54-55.

2. Angle, E. H.: Malocclusion of the Teeth, Philadelphia, 1907.

SCIENTIFIC BASIS FOR THE IDEA OF TRAUMATIC OCCLUSION

A Reasonable Assumption.—There seems to be a reasonable basis for the idea of traumatic occlusion when considered in relation to the age of the patient. It is commonly observed that the cusps of the teeth wear down with age. In many of the prehistoric specimens, the cusps are nearly obliterated. They show much more wear than do those of modern man. Hence, on the assumption that it is natural for the cusps to wear off with age, an unnatural condition is created if they do not do so.

NATURAL PHYSIOLOGIC PROCESSES

Periods of Growth and Active Adaptive Powers of the Organism.—During infancy, childhood and adolescence, there is visible growth of the organism; that is, there is actual increase in its size. At the close of adolescence, a balance of constructive and destructive processes is maintained, and as old age approaches, the destructive processes predominate. Although growth "is not uniform throughout the organism, it proceeds in an orderly and definite manner, in regular sequence, and with strict correlation between the rates of growth in different regions. Eventually the whole system acquires more or less permanent form and dimensions, corresponding to adult state. After this state is reached the constructive processes gradually become less and less active, eventually failing to offset the destructive processes. Death then follows."

During the periods of active growth and the first years of maturity, the adaptive powers of the organism are most active. At this time, habits are being formed and structural organization is being established that will obtain during senescent years. We know that, mentally and physically, childhood, youth and the early twenties are the plastic years for education.

Although the relative positions of the teeth may change or be changed at almost any time of life by virtue of the plasticity of their supporting structures, these supporting structures are, of course, more readily responsive to changing conditions during the growth periods of life, when the constructive processes of metabolism are dominant. When reductive processes actually predominate, we cannot expect the same degree of adaptiveness.

Retrogressive changes after maturity.—Minot[3] designates the progressive stages of cytomorphosis that take place during life. He records the alteration in cellular structure, its differentiation, the change that in all parts of the body marks the passage from youth to old age. After maturity, the various tissues of the body lose some of their finer qualities, and they can no longer do the efficient work they were able to do before. The soft and flexible parts of the skeleton to be found in youthful stages are largely replaced by bone; the brain is less plastic, and the muscles lose their former elasticity; the arteries lose the elastic quality that is proper to them, and by which they respond favorably to the pumping action of the heart. Nevertheless, Nature may still retain her remarkable ability to preserve a degree of harmony consistent with that stage of life. The stiffened arteries require a greater force to drive the blood through them, so the heart enlarges. The organism thus adapts itself to the new unfavorable conditions of the circulation, established by age. These changes were regarded by Minot as natural physiologic processes.

3. Minot, C. S.: Age, Growth and Death, New York, 1908.

Therefore, if it is natural for the cusps of the teeth to wear off, and this abrasion lessens the mechanical stress upon individual teeth, diffusing the more specific strains, then the lack of wear of the cusps due to modern diet subjects the teeth to forces in occlusion that the supporting structures cannot adjust themselves to, when the reductive processes of life have set in. In other words, unless the cusps of the teeth exhibit progressive wear with age, there is created a disharmony between the forces acting upon the teeth in function and the metabolic processes of the supporting structures. Such a disharmony may express itself in a pathologic condition of the periodontal structures. This, I think, is the logical basis of the idea of traumatic occlusion.

GRINDING OF THE TEETH BEFORE MATURITY

The idea of traumatic occlusion should be definitely associated with the developmental processes of the individual. Grinding the teeth of the young before they have reached the age of maturity is the phase of the idea of traumatic occlusion that I question.

Attempts in the literature to substantiate the claim that the dentures of individuals under the age of 25 years frequently show conditions of traumatic occlusion reveal a conception more idealistic than true. The idea of the normal upon which such claims are based is not in conformity with the rules and principles of science; nor are the physiologic characteristics of the periodontal tissues given proper recognition.

THE PERIODONTIST'S CRITERION OF NORMALITY

The periodontist's criterion of normality is repeatedly expressed in the literature as being an ideal of mechanical perfection. Normal occlusion is said to be an ideal mechanical relation of the occlusal inclined planes of the teeth when the jaws are closed. This was the conception of normal occlusion held by the orthodontists at a time when the work was first developed as a speciality. But it is not the prevailing opinion today. Normal occlusion to the orthodontist is not an ideal, of mechanical perfection. A clearer vision of our problem has forced us to abandon some of our earlier beliefs, and not the least among them is the conception of what normal is. We no longer think of the human dental apparatus as a perfect mechanism. Even though we can imagine a scheme of occlusal relations that exhibit mechanical perfection, we no longer expect to find it in actual existence. The fact is that, in occlusion, we are concerned with parts of a living organism, and as such they exhibit the natural variations and defects that characterize all structures, though more especially those less essential to life. The human organism can live without teeth.

IDEAL AND NORMAL

If we study for a moment the terms ideal and normal, we shall find that they are not in any sense synonymous. Webster defines ideal as "A conception proposed by the mind for imitation, realization or attainment; a standard or model of perfection or duty. The ideal is to be attained by selecting or assembling in one whole the beauties and perfections which are usually to be seen in different individuals; excluding everything defective and unseemly so as to form a type or model of the species." So, from the standpoint of the ideal, we should see the living organism as a unit of perfection. The word ideal refers to the subjective. Ideal things do not exist in concrete form. Hence, being a mental image constructed from

the sense impressions derived from the varieties of the most perfect forms obtainable, the ideal of perfection conceived by one person is not necessarily the same as the ideal of perfection conceived by another person.

In addition to the fact that the ideal includes recognition only of the most perfect forms according to the estimates of the human mind, the essential feature of its being a mental creation based upon the imagination rather than upon physical actuality precludes the possibility of its being taken as a scientific standard. Ideal and normal cannot be used interchangeably.

Normal refers to a standard. In morphology, normal signifies a standard determined by the prevalence, the constancy, the frequency of the occurrence of a condition. In physiology, it signifies a functional equilibrium of parts that will best maintain, in its most stable form, the organization of the individual as a whole.

THE SIGNIFICANCE OF TYPE

The normal is ascertained through a concept of type, which itself is an abstraction derived from a study of many different forms; a composite, if you will. Type is the result of bringing together in one concept all kinds, perfect and imperfect, and so, unlike the ideal, is representative of actual conditions.

> The typical form of structure indicates in a general way the arrangement and relation of parts that the forces of adaptation have selected from the stream of evolution as adequate for the life processes of the human organism. Therefore, in as much as the form of structure is a visible manifestation of function, and as typal form reveals adaptive forces efficient in survival, the forms which come within the range of type are normal structures.

Thus, literally, *ideal* occlusion is a creation of the imagination. This scheme of the relations of the inclined planes of the cusps of the teeth served well enough as an hypothesis for the study of occlusion, but it should never have been accepted as normal occlusion. There is no evidence to substantiate such a contention.

If periodontists accept the claim that normal occlusion is a certain ideal relation of cusp surfaces, then all human dentures of all ages need grinding; just as the orthodontists at one time, under a similar delusion, thought all needed orthodontic treatment, for any departure from the ideal of mechanical relations would be abnormal. Orthodontists have been unable to substantiate such a point of view, in fact. Yet it is relevant to this discussion to consider briefly the origin of the theory that an ideal occlusion is normal.

HARMONY AS A CONSISTENT ARRANGEMENT OR COMBINATION OF RELATED PARTS

Following his definition of the line of occlusion, which the periodontist not only accepts but enhances in mysticism,[4] Angle says that "as the dental apparatus is only part of the great structure, the human body, each part and organ of which was fashioned according to lines of design, it must have been intended that the line of occlusion should be in harmony, in form and position with, and in proper relation to, all other parts of the great structure, according to the inherited type of the individual."

Such a conception certainly appeals to the imagination, but does it appeal to reason? Is it consistent with facts?

Regardless of a misinterpretation of the word type in the foregoing quotation, the idea conveyed is a degree of

4. Stillman, P. R., and McCall, J. O.: Clinical Periodontia, pp. 67-68.

harmony of design that does not exist in human form. Although in this overemphasis of one of the inherent tendencies of organic life, i.e., harmonious development, is to be found a logical basis of the ideal conception of the normal, it is not a scientific one.

In 1800, Cuvier first presented the principle of harmonious development. He says, "It is on this mutual dependence of the functions and the assistance which they lend to one another that are founded the laws that determine the relations of their organs; these laws are as inevitable as the laws of metaphysics and mathematics, for it is evident that a proper harmony between organs that act upon one another is a necessary condition of the existence of the being to which they belong." Note that he says proper harmony, not perfect harmony, meaning, in a biologic sense, "an arrangement or combination of related parts or elements that is consistent."

Thus, Cuvier saw in comparative anatomy evidence of a degree of harmony in structural form as a necessary condition of existence. But a "degree of harmony" is not synonymous with perfection of structural conformation. He further states his reason for calling this the principle of existence. He says, "Since nothing can exist that does not fulfill the conditions which render its existence possible, the different parts of each being must be coordinated in such a way as to render possible the existence of the being as a whole." Obviously, this is far from saying that the whole human organism is made up of parts mathematically and mechanically perfect in design. Johnson[5] says:

It seems to me true that the belief that Cuvier's hypothesis can be applied literally to the individual in all phases of its organization, even to the most minute details, is responsible for the assumption that under normal conditions the human teeth in size, form, number and relations are in perfect harmony with the structural design of the whole organism.

Of course, the validity of this assumption involves the question of the extent to which individuals *do* exhibit a perfect harmony of design.

Among the mature forms of lower animal life, wild in nature, perfect harmony of structural conformation seems to be the rule. The teeth appear to be in perfect occlusion; the arch forms and contiguous structures constitute a masticatory apparatus that is most ideal. Even among the individuals of the same species, there is often a similarity in size and form that is amazing. A study of the skulls of nearly any group of full-grown wild animals will give the impression that perfect harmony of design in the structural organization and formation of the masticatory apparatus is inevitable.

But is it true that this is an inherent quality of living organisms, to the extent that it seems to be in the lower forms? I think there is sufficient evidence for reasonable doubt.

There is evidence which favors the belief that many animals are born into the world with deformed dental arches or conditions which favor the development of such abnormalities. The work of the experimental biologists in the field of heredity is evolving a change in the attitude of science toward this question of morphology. Animals are known to have been born with deformities, and the statement is definitely made by Loeb[6] that those generations live and develop that are free from the grosser type of disharmonies, the rest are doomed on account of the gross lack of harmony of the parts. The latter are not seen, which gives the erroneous impression that harmony or design is characteristic of all organisms.

5. Johnson, A. L.: Basic Principles of Orthodontia, Dent. Cosmos, 845 (Aug.), 957 (Sept.) 1923, 65: 379 (April), 503 (May), 596 (June), 719 (July).

6. Loeb, Jacques: The Organism as a Whole, New York, 1916.

The argument in favor of this ideal conception as the normal seemed further strengthened when some dentures of prehistoric man were found to present an occlusion so beautiful as to satisfy the most fastidious of idealists.

The Broomell specimen and several others are frequently used to illustrate this perfection; but, from these few, is it reasonable to assume such a condition to be typical of occlusion today, or any other day? The typical is not derived from the few, but from the many. Furthermore, the typical is not a fixed thing, but a shifting standard, depending on the conditions that influence variation.

Granting that the principle of harmonious development is a potent force in the evolution of complete organisms, the other side of the picture is quite as important.

The knowledge we have today of the nature of living organisms reveals not only the inherent tendency to develop harmoniously as a result of the interdependence of parts, but also the principle of the transmission of unit characters in the law of heredity, which is of equal importance; both seemingly opposed in elementary tendencies. Time will not permit me to elaborate the significance of this interaction. It is sufficient to say that the recognition of it is so generally accepted in science that for us to see nothing but harmony and design in the structural conformation of the human dental apparatus is to stamp our work, both as orthodontist and periodontist, with the seal of superficiality.

The standard of normality of the dental arch that is to govern our procedures must be consistent with facts. However much an ideal system of surface relations of the cusps of the teeth may appeal to the fancy as furnishing an absolute, tangible measure of normality, from the definition of the terms employed, from a study of the principle of harmonious development and from the experience of orthodontic practice, I can find no justification for it. I agree with Hellman,[7] who says. "The normal occlusion conceived by the orthodontist to present 100 per cent perfection is a myth." Ideal occlusion is not normal occlusion. Normal occlusion means that there exists a relation of the teeth in function that will help to establish and maintain in its most stable form the organization of the individual organism. Normal is a standard of a functional nature, expressed in structural organization of different degrees of perfection; never perfect!

If you presume that all human beings have abnormal dentures, then I believe that the condition you profess to correct by grinding or moving the teeth would express an aberration so fundamental in the organization that time would prove your methods inadequate.

It is not to be assumed that this new interpretation is of spontaneous growth. In 1921, Lischer[8] gave an historical survey of the evolution of orthodontia. On this background, he traced the trend of thought that has led up to the strengthening of the scientific quality that dentistry professes to possess. He recognized three periods: first, the period of empiricism; second, the period of idealism, and, third, the period of rationalism. The period of empiricism he describes as the time when attempts were made to adapt occlusal conditions of the teeth to the esthetic requirements of the face. The recognition of an infinite number of facial types brought

7. Hellman, Milo: Variation in Occlusion, Dent. Cosmos, 63: 608-619, 1921.

8. Lischer, B. E.: Dentofacial Deformities, J.A.D.A., 8: 907 (Nov.) 1921.

out the fallacy of such procedure. The period of idealism is clearly marked as that time when it was believed that practically all dentofacial deformities could be fully comprehended upon a basis of the occlusal relations of the teeth, and that the presence of every permanent tooth in ideal occlusal contact with its antagonist was accepted as the basis of the science of orthodontia. It was in criticism of this belief that Case brought out the importance of other facial factors in making diagnosis and declared that extreme deformities called for the extraction of one or more teeth. The controversies precipitated by this criticism by Case, Lischer believes, introduces a present period of rationalism.

The objections to the imposition of a fixed and rigid standard of normality must have been felt for a long time. The appreciation of this rational point of view is clearly expressed in the following quotation[9]:

> Anyone following, even cursorily, the course of orthodontic literature in the past must have noticed that the greater part of it has been concerned with malocclusion, its causes and treatment, and the occlusion or the standard of normality to which we compare the abnormal has been rather taken for granted. Not unnaturally perhaps, for it is the abnormal which we have to treat; but equally is it of cardinal importance that we should have a very clear conception, well grounded in fact, of what constitutes the normal standard of the teeth and jaws. The tendency has been, and still is to a great extent, to construe the normal somewhat narrowly and rigidly. A sort of archetypal standard of occlusion has been formulated, every deviation from which, no matter how little, constitutes an abnormality which to some spells the need for dental intervention. It is obvious that the whole of orthodontia hinges on the question as to what constitutes the normal.

9. Editorial, Brit. Dent. J., 42 (Sept. 15) 1921.

There are signs that a change is imminent; here and there some are beginning to question this somewhat arbitrary definition of the normal and to doubt whether it can be stated in terms of the absolute as though it were a definite entity common to mankind. It has been realized that there is such a thing as variation—a belated discovery it might seem to the biologist, especially as there are few branches of biology which better illustrate the importance and extent of variation than comparative dental anatomy.

All organisms and parts of an organism tend to vary; were it not for this pliable quality of protoplasm, life might still be unicellular. Surely the teeth and jaws and their mutual arrangement, which we term occlusion, are not exempt but also tend to vary; as with other parts of the body, variations tend to occur round a certain mean; by using biometrical methods we can classify these variations and state that a certain average mean represents the normal, but it is not rigidly fixed, for the variations in one or the other direction cannot be regarded as abnormal. Thus, the normal is a group rather than a fixed standard. We find that the variations cluster most thickly about a mean average which we may regard as the normal and that they gradually tail off in both directions until they represent so extreme a divergence from the average that we may be justified in regarding them as abnormal.

All this is a biological commonplace, but it is none the less true that its application to orthodontia is comparatively new.

PHYSIOLOGIC CHARACTERISTICS OF THE SUPPORTING STRUCTURES OF THE TEETH; PLASTICITY AND ADAPTIVENESS

Stillman and McCall say (page 63), under the definition of traumatic occlusion, "When a condition of plus-occlusion is found to be present, one of two things will occur: either Nature will provide an increased alveolar support, a condition revealed in the radiograph as a condensing osteitis, or a breaking down of the supporting tissues will take place. . . .Unfortunately the tendencies of civilization are toward more frail alveolar structures, the consequence

being a corresponding tendency toward degeneration." Such a conception of bone as McCall pictures in this paragraph is misleading, for it conveys the impression that alveolar structure is a hard and unyielding substance, something fixed and congealed; and its remarkable property of modifying its own structure to meet changing stresses is given a pathologic interpretation in the terms of an inflammatory condition, called osteitis.

Many of the mysteries concerning the nature and physiology of bone are still unsolved, but the experiments and observations of a long list of investigators have been extensive enough to establish the property of plasticity as well as its adaptive nature. John Hunter, in 1767, was so impressed with the way bone was built up on one day and carried away the next that he attributed a form of "consciousness" to living bone. The observations he made on the neck of the femur established the fact that bones were being constantly remodeled from infancy to adult life, and, a hundred years later, this fact gave Wolff the key to his law of transformation of the trabecular architecture and the external form of bone. Briefly, Wolff's law is: "A bone has the power to adapt itself to the burden it has to bear." Noyes[10] calls attention to "a continual oscillation between formation and destruction by means of which it is perfectly adapted to its mechanical environment." Adami describes the differentiation of its cells and their source of supply. It should be constantly borne in mind that bone is a living tissue, subject to the same economies of metabolism as any other living tissue; that it is in a constant state of flux, undergoing both progressive and retrogressive changes throughout its life. The shifting developing forms assumed by the living jaws *demand* the plastic medium of the living supporting structures in order to allow the teeth to establish an equilibrium in either normal or abnormal occlusion.

The most complete development of these forms is determined by the result of the combined influence of a complex of physiologic processes: the *natural* forms of the teeth and their mutual mechanical relations are essential parts in this complex, and it is the purpose of dentistry to preserve and restore them.

But the waning of the adaptive quality of the supporting structures of the teeth, I believe, should be accompanied by a wearing down of the cusps of the teeth, as a natural physiologic process of a more advanced stage.

Dentistry must acknowledge the service rendered by the periodontist in emphasizing occlusion, but let *him* respect the natural forms of the teeth and give proper recognition to the physiologic characteristics of the periodontal tissues, constantly exhibited during the constructive periods of the individual, and when the retrogressive processes set in, he may then supply, artificially, the harmonizing conditions naturally supplied in more primitive days.

10. Noyes, F. B.: Textbook of Dental Histology and Embryology, Philadelphia, Lea & Febiger, 1915.

INTERPRETATION OF DENTAL AND ORAL ROENTGENOGRAMS

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THE correct interpretation of dental and oral roentgenograms is an accomplishment that every dentist should possess. It should be considered a requisite of modern dentistry. There are many members of our profession today who think that interpretation of these roentgenograms is an extremely simple matter. This erroneous idea is doubtless the cause of the needless extraction of many useful teeth. Therefore, careful study and judgment must be at all times exercised.

To acquire an accurate knowledge of the anatomy and physiology of the structures involved is the first step toward a correct interpretation. The second step is to become familiar with their roentgenographic appearance under normal conditions; otherwise it is impossible to recognize any pathologic condition unless it is obvious. The third step is to understand thoroughly the fundamental rules of roentgenographic technic; to know when examining a roentgenogram whether or not the technic involved in its making was correct or faulty, and if faulty, whether or not the degree of fault is sufficient to render it so inaccurate as to be useless. The fourth step is to employ the original negative, film or plate in making the diagnosis, seeing that it is properly illuminated.

The illuminating cabinet should be so arranged as to receive varied degrees of light. This may be accomplished by placing a small rheostat in the circuit leading to the electric bulb, which, in turn, should be placed behind a ground glass, so that the light transmitted will be equally distributed and free from shadows. The varied degrees of light made possible by the use of a rheostat enable us to bring out various sets of shadows by increasing or decreasing our source of light.

The essential requirements of roentgenograms to be used as an aid in diagnosis may be briefly considered under two classes; the extraoral and the intraoral. The first, or extraoral, covers the grosser lesions, such as fractures of the maxillae, impacted or unerupted teeth, large cysts, odontomes and foreign bodies. The second class, or intraoral, covers those cases in which individual teeth with their investing tissues are under examination. It is extremely important that the periodontal membrane and the alveolar bone surrounding the roots, both marginally and apically, be shown to the best advantage. The normal alveolar process has a characteristic appearance when properly roentgenographed, owing to its anatomic structure and chemical composition. It has a spongy appearance due to the irregularity of the cancellations. The spaces that constitute spongy bone are irregular in shape and size, as the lamellae

are arranged in an irregular manner. The groups of lamellae form strands of bone tissue, which unite, thus forming irregular shaped cavities. Therefore, in a roentgenogram of normal spongy bone, we see irregular dark areas (no two being alike) surrounded by fine white lines.

When the bone is subjected to injurious influences, the cancellations lose their clear-cut borders and become smaller and closer together. Whenever cancellated structure tends to become regular, ill-defined and homogeneous, the suspicion of a pathologic condition is entirely justified.

As the presence of calcium salts in the bone tends to obstruct the passage of the rays, any increase of this factor will make itself apparent on the photographic negative as an area of greater density or a lighter shadow. A decrease in the normal amount of calcium salts will show an area of lesser density or a darker shadow. Around the individual teeth, there are two structures that have a characteristic roentgenographic appearance and should be studied very carefully when any pathologic condition is suspected: the periodontal membrane, which shows in the roentgenogram as a fine dark line surrounding the roots of the teeth, and the lamina dura, shown in the roentgenogram as a fine white line between the periodontal membrane and the cancellated bone.

If the pathologic process has its origin within the tooth, the first structure to show a deviation from the normal in the roentgenogram is the periodontal membrane, which becomes thickened at the point of irritation. If the pathologic condition continues to progress, hypertrophy of the periodontal membrane continues, causing pressure on the lamina dura, which is finally broken down at the point of irritation. With the changes in nutrition that accompany a progressive inflammatory process, there is a decrease of calcium salts in the adjacent alveolar bone, which lessens the resistance to the passage of the rays, causing the photographic emulsion to be more readily affected and showing on the negative as a darker area.

In many cases, we find that a thickening of the periodontal membrane is due to such conditions as occlusal traumatism, pressure or chemical influences. We must bear in mind that infection and inflammation are not necessarily synonymous, and that the clinical facts and case history are very important factors in roentgenographic diagnosis.

There are many other anatomic landmarks in the upper and lower jaws that are very important in roentgenographic diagnosis. In the lower jaw, we find the mental foramen below and between the roots of the bicuspids. This appears in the roentgenogram as a dark shadow and is often taken for a pathologic condition arising from the bicuspids. There are two methods of differentiation between the normal and pathologic in this region by the use of the roentgenogram:

1. By following the outline of the lamina dura around the roots of the bicuspids. If it is intact, the suspicion of a pathologic condition may be virtually eliminated. There are a few cases in which the apical foramen lies either buccally or lingually, and in such cases the lamina dura is destroyed either buccally or lingually, making it impossible to be seen, as it is superimposed on the root. In such cases, when in doubt, the faradic current should be used to test the pulp.

2. By following the outline of the mandibular canal, which is a very important landmark in the lower jaw, running from the mental foramen distally below the roots of the teeth to the third molar where it curves upward and backward in the body of the ascending

ramus, immerging at the mandibular foramen.

It appears as a dark shadow in the roentgenogram, and by following the outline of the mandibular canal forward, to the bicuspid region, it will be seen to curve up and backward, terminating in the mental foramen. By this method, we may also eliminate any suspicion of a pathologic condition.

The other landmark is the external oblique line. It is a ridge of cortical bone coming down from the anterior border of the ramus and extending forward to the second molar on the external plate of the mandible. Being cortical bone, it appears as a light shadow in the roentgenogram, and at times is superimposed over the roots of the molars. This happens very seldom and only in certain types, and should not be confused with condensing osteitis.

In the upper jaw, we find many anatomic landmarks. In roentgenograms of the incisors, we find just above and between the central incisors a dark shadow, which is the anterior palatine foramen; and, above the foramen, we find two large dark areas, which are shadows of the nasal fossa, and must not be mistaken for cyst formation.

In roentgenograms of the bicuspids and molars, we find above the roots a large dark area, sometimes dipping down between the roots of the molars. This is the maxillary sinus, and at times there appears in the dark shadow cast by the maxillary sinus a fine light shadow, which extends up into the area. This is the septum in the floor of the maxillary sinus. It often appears that the lingual root of the molars is projecting into the antrum. In such cases, we must look for the fine outline of the lamina dura, which surrounds the root. If this is present, we may safely say the root does not extend into the sinus; but, if it is not present, the root does extend into the sinus. We often see, in roentgenograms of the upper molars, a very dense light shadow, which extends over the roots, rendering diagnosis very difficult. This is the shadow of the molar bone.

In roentgenograms of the upper third molar region, there are three important landmarks: (1) the tuberosity of the maxilla, which is posterior to the third molar; (2) the hamular process of the sphenoid bone, which cannot always be seen but must be recognized, extending downward and backward in the space behind the tuberosity, and (3) most important in this area, the coronoid process of the mandible, which appears as a light triangular shadow in the space posterior to the tuberosity.

Another landmark that it is very difficult to recognize is the posterior palatine foramen, which appears as a dark area above and between the roots of the first and second molars. This is generally obliterated by the shadow cast by the maxillary sinus.

There are in general two types of lesions in which examination by the use of the roentgen ray is an aid to diagnosis and prognosis: (1) lesions involving the periapical region of the tooth, dependent on infection following death of the pulp, and (2) lesions involving the investing tissues of the teeth, the periodontal membrane and alveolar process, not dependent on death of the dental pulp, but in which the infection starts at the gingival margin, so-called pyorrhea alveolaris, or more correctly, chronic suppurative osteopericementitis.

A third type is occasionally seen, the pericemental abscess, in which an inflammatory process is set up in the pericementum of a tooth independently of disease of the pulp. There are three sources of infection. The organism may

come in through the gum margin or from neighboring diseased teeth, or it may be carried from other parts, by the blood stream.

There are four stages of periapical disease that concern us in roentgenographic work: 1. Chronic proliferative pericementitis, causing a slight thickening of the periodontal membrane about the tooth apex, but without any appreciable loss of bone. 2. Chronic rarefying osteitis with granuloma. A slow disintegration of bone takes place in a circumscribed area about the tooth apex, bone tissue being replaced by granulation tissue. The tooth apex may project into the bone cavity; may be shortened or roughened from irregular absorption of the cementum, or may present enlargement due to hypercementosis. 3. Chronic rarefying osteitis with suppuration. There is an area of bone destruction that the space is entirely bathed in pus. The apical periodontal membrane is nearly always destroyed, the root end being roughened with necrotic cementum bathed in pus. The roentgenogram presents a blurred area of lessened density as compared with the surrounding bone. 4. Chronic rarefying osteitis with cyst formation. This stage succeeds that of granuloma, the cavity in the bone being filled with clear fluid surrounded by a fibrous sac. In the roentgenogram the cyst appears as a clearly defined dark area. The first of the various stages of infection of the investing tissues of the teeth beginning at the gingival margin is gingivitis, which is confined to the gum tissue and shows no roentgenographic change. Later, the periodontal membrane is attacked, which shows in the roentgenogram as a thickening of the membrane, starting at the gingival margin and progressing toward the apex of the tooth. Following this, the bone becomes affected, the condition being manifested in the roentgenogram by absence of the apex of the bony septum, called osteopericementitis. The bone surrounding the tooth is now progressively destroyed toward the apex, and in time the bony support of the tooth may be lost.

I have mentioned condensing osteitis, but I have not fully explained the reason for the existence of this condition. It is found generally in the bone structures that have formerly been occupied by teeth, but have had some chronic pathologic condition around the apical region. On removal of the teeth, new bone has formed; but in these particular cases, an excess amount of calcium salts has been deposited, making the bone much denser. Therefore, in the roentgenogram, it shows as a lighter shadow than does the surrounding structure.

As regards dental root cysts, to get a comprehensive knowledge of their presence, we must first go back to the development of the teeth. The enamel organ is composed of three layers, the outer layer consisting of epithelial cells, the middle layer, of mucoid tissue, since it presents a network of stellate cells separated by large spaces. The middle layer is best marked over the upper part of the crown, thinning out at the sides and entirely disappearing at the margin of the enamel organ, where the outer and inner layers of the latter are continuous.

The inner layer of the enamel organ comprises a single row of closely set, tall cylindrical elements, the ameloblasts, which are best developed where they cover the apex of the dental papilla. As the inner layer approaches the outer layer, the ameloblasts gradually diminish in height until they are replaced by low cubical cells, which, at the margin of the enamel organ, are continuous with the

epithelium of the outer layer. At this point, the outer and inner layers, which are now one, go down, invaginating the mesodermic tissue, which forms the dental papilla. The continuation of the outer and inner layers is called the epithelial sheath of Hertwig, and its purpose is to give form to the roots.

The mesoblast undergoes differentiation into a connective tissue envelop, known as the dental sac. This occurs at the same time as development of the enamel organ and growth of the dental papilla.

The part of the sac opposite the root is at first prevented from coming into direct contact with the dentin by the double layer interposed by the epithelial sheath. This relation is maintained until development of the cementum begins, when the vascular tissue of the sac breaks through the epithelial sheath to reach the surface of the dentin. In consequence of this invasion, the epithelial sheath is disrupted into small groups or nests of cells, and these persist for a long time within the periodontal membrane, into which the dental sac is later converted. These nests of cells are known as epithelial cell rests of Malassez.

Among the connective tissue elements of the inflammatory granuloma developing as a result of infection are frequently found masses of squamous epithelium believed to be the epithelial rests of Malassez. Proliferation of these epithelial cells takes place as a result of the chronic inflammatory process. The mass of epithelium then breaks down in the center, it is believed by fatty degeneration, and a space is formed containing fluid. The cyst cavity gradually enlarges, the pressure of the fluid causing atrophy of the epithelial cells, until the wall of the cyst consists of a dense fibrous capsule lined with, at most, a few layers of epithelial cells. All traces of epithelium may disappear. The cyst fluid is usually clear and sterile but may become infected through the cyst wall.

Other cysts coming under our observation are: (1) multilocular cysts, which may arise from abnormal growth of epithelial rests found in *(a)* diverticula from the enamel organ or *(b)* an aborted tooth germ; (2) follicular or dentigerous cysts, arising from an excessive amount of secretion of fluid between the enamel and the tooth sac; (3) compound follicular odontomes, which are very rare and are thought to arise from the dental sac; (4) radicular odontomes (origin), an aberration of the dentin, being therefore confined for the most part to the root portions of the teeth; (5) composite odontomes (origin), aberrations and abnormalities in the development of the whole or part of the constituents of the tooth germ, and (6) extracapsular odontomes (origin). The calcified mass is obviously the dental capsule, which has undergone a retrogressive metamorphosis. Roentgenographic examination of the teeth reveals marked decalcification of the jaw, with absorption of the roots about the left upper molars, and absorption about the roots of the right upper bicuspids and the right upper molars. There is a healed abscess about the roots of the right lower molar.

BALANCED OCCLUSIONS

By VICTOR H. SEARS, D.D.S., Salt Lake City, Utah

(Read before the National Society of Dental Prosthetists, Dallas, Texas, Nov. 7, 1924)

THE principal interest of prosthetists a decade ago was focused on further development of impression making, with attention to considerations of balanced occlusions secondary. More and more interest has developed in occlusion, until the present time, when the interest may be characterized as intense.

Although the last word has not been spoken, we are now in possession of a sufficient number of facts, so that it is possible to arrive at a satisfactory and workable solution of the problem of balanced occlusions. A calm and thoughtful consideration of the facts brought out by our geodesic committee and others enables us to reduce the situation from chaos to order.

The known physical factors which govern balanced occlusions are four: (1) arrangement of masticatory surfaces, (2) jaw relations, (3) direction and magnitude of forces applied and (4) tissue resiliency. Having once accepted the hypothesis that the above named factors are involved in the problem, we concede that they must be considered in every full denture restoration. In my opinion, anything short of this constitutes an admission that perfection is not our goal.

Throughout our discussion it is of the utmost importance that we recognize as two separate and distinct things (1) the positions of the jaws to each other, which we shall designate as relations, and (2) the positions of the masticatory surfaces with reference to each other, which we shall designate as occlusions. We shall speak, then, of relations of the jaws and occlusions of the masticatory surfaces.

Occlusions are contact positions of the masticatory surfaces with reference to each other. Balanced occlusions are contact positions of the masticatory surfaces having contact points so distributed that forces simultaneously applied at these points will maintain equilibrium. Unbalanced occlusions are contact positions of the masticatory surfaces having contact points so distributed that force applied at these points tends to disturb equilibrium.

You are already sufficiently well acquainted with definitions of centric, protrusive and lateral occlusions, for this discussion.

Relations, as we have agreed, are the positions of the mandible with reference to the maxilla. Unstrained relations are relations of the mandible to the maxilla in which all of the controlling tissues are relaxed except to the extent of counteracting the force of

gravitation. Strained relations are relations of the mandible to the maxilla in which some of the tissues exert force in excess of that which is necessary to counteract the force of gravitation.

The mandible is in centric relation when in its retruded rest position. The apex of the Gysi gothic arch is acceptable in recording centric relation. The mandible is in protrusive relation when it assumes a position directly anterior to the position of centric relation. It is in lateral relation when a point of the mandible assumes a position to the right or left of centric relation.

RESILIENCY

Resiliency of tissues is the springiness or the property of tolerating displacement under temporary force and resuming the original shape after the action of force has ceased. Tissue resiliency is responsible for a change in positional relation of a denture to its osseous supporting structure. It is also responsible for a change in positional relation of the mandible to the maxilla. The effect depends principally on the displaceability of the supporting tissues under both dentures and on the displaceability of the interarticular tissues. It might also be theoretically contended that the effect depends on the flexibility of the restoration and on the distortion of the osseous structures.

A denture is in unstrained relation to its respective jaw when no forces act on it. In this position, the denture rests gently upon the tissues in their relaxed state. Immediately on the application of force, the supporting tissues are displaced (or other parts give), and the denture is brought into a strained position.

As the magnitude and direction of forces applied for registering the relation of one jaw to the other are beyond the control of the dentist and the patient, and cannot, with our present methods, be accurately measured, it is logical to conclude that any method suggested to record jaw relations under pressure will prove inaccurate.

Of all magnitudes and directions of forces which a patient can possibly apply, there is only one definite and reliable combination of the two, and that is the magnitude of the force zero, a force which has no direction. A method was therefore developed to register all relations with a closing force of zero; that is, when the masticatory surfaces are in balanced contact and no closing pressure is applied.

Biting in itself infers the application of force. Therefore, biting into wax or any other material is always coincident with an application of force. In order to reduce the magnitude of this force to a practical minimum to begin with, the material used for making records should be of very soft and even consistency. It should also possess the property of becoming hard after the record has been obtained. Certain wax compositions possess both of these properties, the first when heated and the second when cooled. Because of our inability to predetermine and maintain exactly the required distribution and consistency of interposed wax, some parts of this wax offer greater resistance than others, and thus a greater strain is transmitted to the tissues in the regions of greater resistance.

The parts of the masticatory surfaces that cause tissue strain are detected in various ways: (1) visually, (2) digitally, (3) by direct and indirect measurements and (4) by the

interpretation of the patient's sense of touch.

With an opening that circumstances warrant,[1] we record the unstrained centric relation of the mandible for the purpose of transferring the relation to the mechanism. The record of the position of the mandible to the maxilla in its closing under pressure has been popularly called the bite and the check-bite, but we have no accepted term to describe the record of the position of the mandible under no pressure. The term rest record is suggested. The stopping position of the mandible in unstrained centric relation or the centric relation rest record is obtained in centric relation, associated with a definite opening with all tissues in relaxed balance when the head is upright. This centric relation rest record is the registration of that position to which we refer all mandibular positions.

With the factors all in mind, we apply any suitable technic in harmony with the principles recognized. The following technic for recording unstrained centric relation is suggested.[2]

The patient is directed to close the mandible to the desired jaw separation in centric relation in order to record the position of the jaws to each other, thus establishing the space into which the dentures are ultimately inserted. In making this first record with occlusal rims or their equivalent, let us assume (as we should) that there is unequal resistance to the closing force at the various parts of the masticatory surfaces and, in consequence, unsuitably distributed pressure upon the various parts of the supporting tissues.

Those parts of the masticatory surfaces which intrude under pressure are the ones which become raised when the pressure is released. These raised parts then make premature contact upon closing the masticatory surfaces. The raised parts thus detected may be reduced or the parts making no contact built up.

By means of one or both of these expedients, which may have to be applied repeatedly, the wax is reduced in height or built up until an even contact of the entire surface under no pressure is accomplished. The very last operation usually is to heat lightly the entire surface and to direct the patient to close very gently into the rest record which when chilled is again tested.

After the centric relation rest record has been obtained, the other unstrained relations (protrusive and lateral) are recorded, in order that the masticatory surfaces will assume similar positions on the mechanism to those assumed in the mouth. In all working positions, the occlusions in the mechanism must be in harmony with those of the mouth.

With the mechanism properly set, the teeth are arranged to conform to the requirements of the various jaw relations and the dentures are vulcanized.

After vulcanization, a similar technic may be employed for the purpose of again setting the mechanism, if necessary so that each occlusion may be adjusted to harmonize with its corresponding unstrained jaw relation. Each denture position on the mechanism will thus be made identical with its relative position in the mouth in the various unstrained relations of the mandible to the maxilla.

If the masticatory surfaces are ground[3] to meet the geometric conditions of the case, it may still be necessary to compensate for the yielding of

1. Monson, G. S.: Case Histories, J.A.D.A., 11: 55 (Jan.) 1924. Wright, W. H.: Deafness as Influenced by Malposition of the Jaws, J.A.D.A., 7: 979 (Dec.) 1920. Crawford, J. W.: Esthetics, J.A.D.A., 11: 983 (Oct.) 1924.

2. Hanau, R. L.: Full Denture Technic, Ed. 3, 1924.

3. Bonwill, W. G. A.: Litchе's American System of Dentistry, Vol. 11.

the tissues under chewing force. A scientific technic for the compensation of tissue resiliency may offer a legitimate field for the check-bite or a record obtained under biting force. In other words, it may be possible to employ a series of rest records for the purpose of adjusting the mechanism and then a series of bite records for the purpose of grinding. Without the use of bite records, if it is learned that there is too much pressure at one part under working conditions, that part may be relieved by grinding away some of the masticatory surface overlying the part of too much pressure.

Having employed this correction technic, and having accomplished the desired balanced occlusions, the problem has been solved for the moment. Subsequent modifications of the masticatory surfaces may become necessary after the dentures have been worn. Changes requiring these subsequent modifications in the masticatory surfaces may to an extent be anticipated and provided for in the correction technic if deemed advisable.

From the foregoing, it will be seen that any attempt to force a set of jaw relations differing from those intended by Nature may, in some cases, influence the positions assumed by the mandible; but principally this attempt at forcing the human mandible to assume arbitrary positions will manifest itself unfavorably—particularly in tissue trauma. This brings us to the conclusion that tissue trauma results from unbalanced occlusions, and thus disposes theoretically of all mechanisms incorporating an arbitrary series of occlusions. Speaking from a practical standpoint, the correction on an adjustable mechanism of a large number of prosthetic dentures originally constructed on arbitrary mechanisms will convince any open minded skeptic.

The application of these principles,[4] using the technic referred to, marks, to my mind, the highest point thus far attained in the field of prosthetic denture occlusion.

4. Gysi, Alfred: Dent. Cosmos, 40: 11-4, 1898.

ETIOLOGY OF PYORRHEA ALVEOLARIS, WITH A SIMPLIFIED TREATMENT*

By THOMAS B. HARTZELL, M.D., Minneapolis, Minn.

(Read before the American Dental Association, Louisville, Ky., September 21-25, 1925)

PYORRHEA alveolaris was first described by Fauchard in 1746 as a purulent inflammation of the dental periosteum, with progressive necrosis of the alveoli and looseness of the teeth. I prefer the term pyorrhea alveolaris to describe this disease rather than the newer term periodontoclasia, for the reason that the former term implies the breaking down of the tissue about the teeth by bacteria, while the latter implies a breaking down from any cause whatsoever. To illustrate: The loss of bone in front of a tooth being moved by orthodontic processes, as well as the loss of bone as the result of traumatic occlusion, is, I believe, covered by the general term periodontoclasia. On the other hand, the destruction of tissues by suppuration, which depends on bacterial action only, is more clearly described by the term pyorrhea alveolaris. I cannot attempt to recite the bibliography of this subject. Volumes have been written on it, and time does not permit.

Pyorrhea can exist only as the result of activity of streptococci and staphylococci, which gain access to the tissues surrounding the teeth by digesting the epithelium lining the gingival crevice. Growing as they do in vast numbers on the necks of the teeth (Figs. 1 and 19), these organisms create ferments, which destroy the tissue adjacent to them, and thus are enabled to invade the deeper structures, where they set up a series of inflammatory changes through the action of their toxins and ferments, the latter alone being responsible for the breaking down and solution of tissue, and the ferments and toxins acting together to create inflammation, changing the appearance of the tissue from pink, and a normal firm condition, to the lavender of inflammatory disease, and causing the tissues to show microscopically the characteristic appearance of a mixed streptococcal-staphylococcal infection, the tissue becoming granulomatous as to the deeper parts and suppurative as to surface of the ulcers about the teeth. The further evidence upon which we base the conclusion that pyorrhea is possible only as the result of the activity of these bacteria, is the fact that the disease is never found in sterile tissues and, on the other hand, whenever pyorrhea is known to exist, these germs can be obtained on culture from the deeper structures around the teeth; also, sections of the tissue in which the teeth are located when properly stained show these bacteria distributed in them. (Figs. 6 and 7). Again, if the teeth are removed, the evidence of the disease promptly disappears, and the sockets

*The discussion of this paper will appear in the next issue of THE JOURNAL.

fill and are eventually covered with a normal mucous membrane; which shows further that the disease is dependent on something associated with the tooth itself, that something being, as I said before, the powerfully invasive bacteria growing on the sides of the tooth, from which they enter the tissues. Further proof that the disease depends on bacteria for its origin and course is afforded by the fact that growth of bacteria on the tooth sides can be prevented by a daily system of cleansing and scouring, which reduces

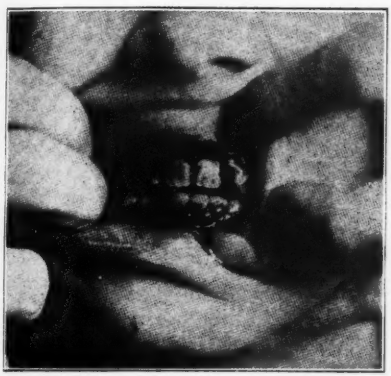


Fig. 1.—Bacteria stained en masse on the necks of teeth. The ferment from these organisms causes the lesion that opens the door of the surrounding tissues to the further invasion of pyogenic bacteria. Without the stain the teeth are a beautiful white because the bacteria are transparent.

Fig. 3.—Venae extending almost to the gingival crevice and leading into the periodontal membrane: *g*, gingival edge; *o*, opening into vessels of periodontal membrane; *d*, dentin; *b*, bone; *v*, network of vessels.

Fig. 2.—Normal gingival tissue, showing the epithelial lining of the gingival crevice unhurt by bacterial ferment.

their number to such a degree that they do not make sufficient ferment to continue to enter and destroy the tissue; and, the supply of invaders once stopped, the blood cells overcome those that are at work in the tissues, so that they rapidly return to normal. Both streptococci and staphylococci are more easily destroyed by the fixed cells than is the tubercle bacillus, which is more resistant to the attack of the blood cell because of the larger fat content of its protecting surface; if the supply of

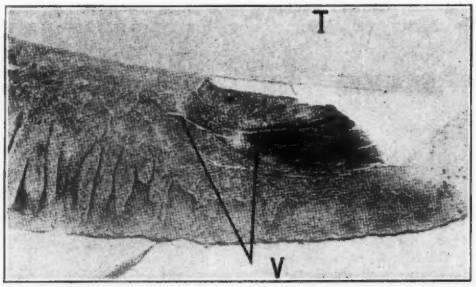


Fig. 4.—Lesion less than one-sixteenth inch in diameter. *V*, vein; *T*, tooth gingivitis. Human lesion showing the same kind of leukocytes in its deeper parts as are shown in the heart muscle in Figure 5.

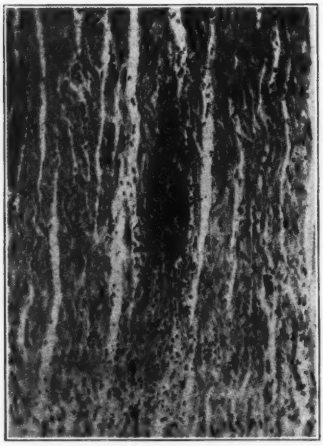


Fig. 5.—Photomicrograph of heart of rabbit in which acute myocarditis was produced by injection of material taken from a dental abscess in a patient suffering also from an acute iritis.

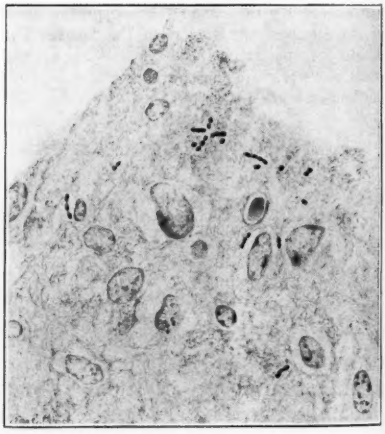


Fig. 6.—Section of tissues 7 microns thick showing bacteria at that depth in tissue, in a field approximately one thirty-second inch in diameter. Consider the infinite mass of bacteria in a section of gingival tissue one-eighth to one-fourth inch square, producing toxins and ferments, which in turn dissolve tissue and set up an inflammation in it, producing edema and swelling.

streptococci and staphylococci is shut off either by extracting the tooth on whose surfaces they grow and from which they enter the surrounding structure, or if the tooth's surfaces are as free of bacteria as they should be, healing will take place with the same certainty as if the tooth were removed. Streptococci, staphylococci, tubercule bacilli and *Spirochaeta pallida* may live in the tissues for a long period. Goadby found pus-forming bacteria in the scars of wounds months after healing had taken place. Unlike tuberculous and syphilitic lesions, streptococcal lesions of the gingivae can be reached by local treatment.

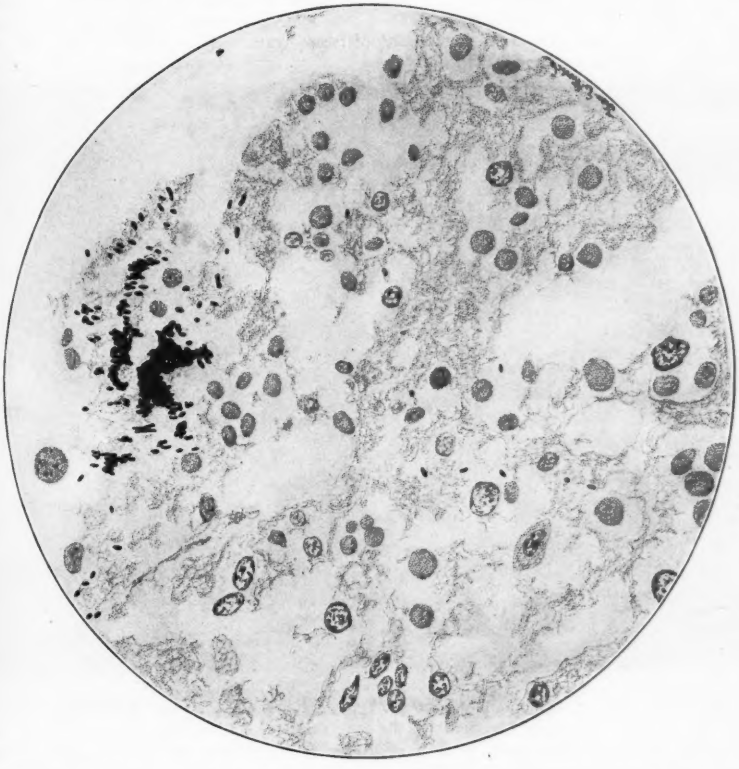


Fig. 7.—Section of gingival tissue 7 microns thick, showing great masses of cocci on the surface of what was the ulcer, and cocci distributed through the deeper tissues as well. (The originals of these sections may be seen in the library of the department of pathology, School of Medicine, University of Minnesota.)

Any form of physical disability or ill health that lowers the resistance of the patient permits increased bacterial activity of all types. The bruising of the periodontal membrane by traumatic occlusion has given rise to the popular

fallacy that traumatic occlusion is the cause of pyorrhea. This can be readily disproved by the fact that malocclusion without bacteria does not cause disease, as the following cases show:

REPORT OF CASES

CASE 1. (Fig. 8).—In a patient, aged 58, the history shows that, because of the absence of the lower central and lateral and the upper lateral incisors, the teeth have been driving steadily forward for many years, until the space existing because of the lack of six teeth has been practically filled. The molars and bicuspids are leaning forward, having been driven under traumatic occlusion until the central and lateral spaces are filled. The bicuspids and cuspids are leaning at an angle of 45 degrees forward and toward the median line. Yet, on close examination of this case, no suggestion of inflammation about the teeth is found. The tissues are all firmly attached, and are pink, firm and resistant.

CASE 2. (Figs. 9 and 10).—In a man, aged 38, the whole occlusion, until about eight years ago, was between the third molars. The second molars have been brought into partial occlusion by grinding the molars. This case has been in traumatic occlusion for at least fifteen years. The gingivae are pink and hard; the tissues are well attached at the gingival margins; and not the slightest evidence of inflammation is to be found in the tissues contiguous to the teeth.

Fig. 8 (Case 1).—Cast showing how the lower teeth have driven forward to fill the spaces that should have been occupied by the lower lateral and central incisors, which lean inward and forward. The upper teeth have driven forward until the space occupied by the lateral incisors has been obliterated. There is no pyorrhea.

CASE 3. (Fig. 11).—A man, aged 33, whose right upper third and lower first molar were extracted three years ago, presented one of the most pronounced malocclusions that I have ever studied. The casts herewith shown indicate that the molars on the left side are out of balance fully one-eighth inch. The

right lower molars lean forward and in, and have moved bodily forward. The left lower second and third molars are in position and are being traumatized daily. The gingivae about these teeth are pink, firm and well attached, and do not betray the slightest suggestion of inflammation.

CASE 4. (Fig. 12).—The patient was a woman, aged 70. The cast herewith presented shows the teeth to be in powerful malocclusion, which commenced forty years ago, following the extraction of the teeth missing in the cast. There was no pus present on examination, and no change in bone except that due to pressure.

CASE 5. (Fig. 13).—In a woman, aged 77, many teeth were absent through extraction, and all remaining were in irregular position, traumatic occlusion having existed from early childhood. On examination, the gums were pink, firm and well attached; and there was no bleeding at any point.

CASE 6. (Fig. 14).—These casts from the mouth of a woman, aged 30, were given me by Dr. L. L. Barber of Toledo. It was possible to squeeze pus from the margin of the gums any place in the mouth. Deposits were removed, and the patient was taught how to use the brush. She returned to Dr. Barber for treatment recently, and he states that the soft tissues in this case have been restored to health without medication, by the faithful use of the brush.

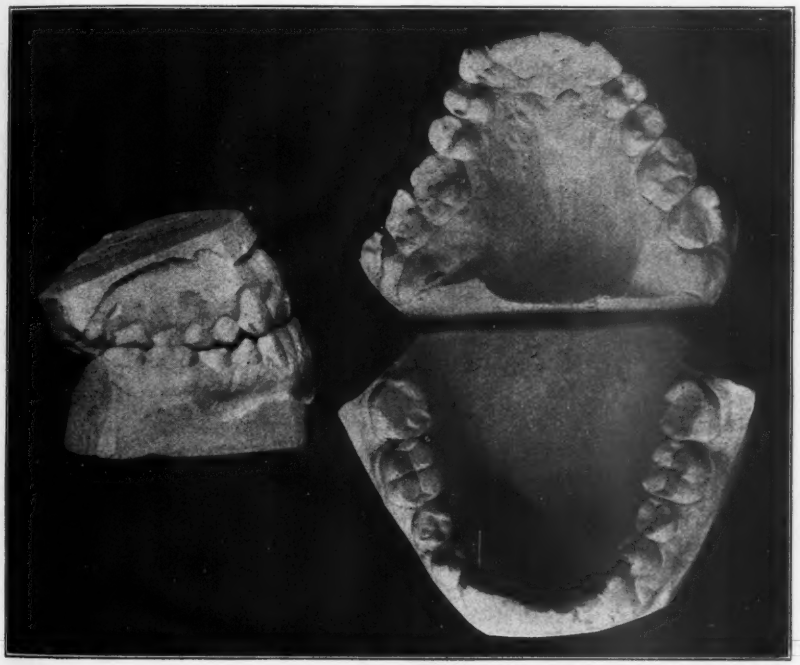


Fig. 9 (Case 2).—Cast showing traumatic occlusion. There was no pyorrhea. Traumatic occlusion is any occlusion that applies force which tends to drive teeth into new positions by causing osteoclasis of bone.

Here is a vigorous pyorrhea with traumatic occlusion, cured by the removal of deposits and daily efficient use of the toothbrush, each tooth being

scoured until clean. If traumatic occlusion were the actual cause of this pus formation, we certainly could not expect to gain cessation of infection without correcting the malocclusion. Notwithstanding the fact that this has not been done, the case shows hard, pink gingivae, with no inflammatory exudate, as the result of an excellent, daily, self-administered prophylactic treatment with the toothbrush.

Fig. 10 (Case 3).—Models mounted in Monson instrument to portray the fact that there is a difference of one-eighth inch in balance of the two sides. There was no pyorrhea.

Fig. 11 (Case 3).—Cast showing right side. There was traumatic occlusion but no pyorrhea.

CASE 7. (Fig. 15).—All the teeth were in normal occlusion, and the patient had complained of no discomfort until lately. Examination revealed the fact that the tissues were swollen, and thickened, and there were pyorrheal ulcers around most of the teeth, from one-eighth to two-eighths inch deep. In spite of the fact that normal occlusion had always obtained, bacteria had invaded the tissues, and pyorrhea had existed for several years about the whole denture.

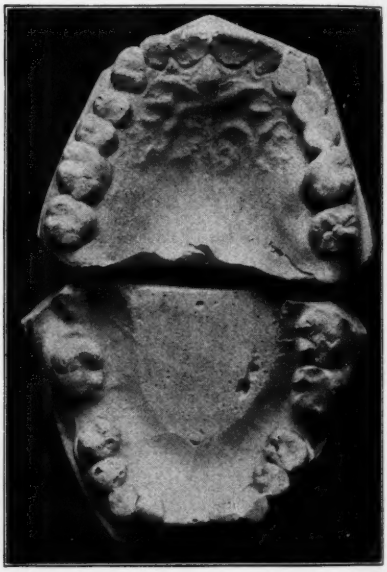


Fig. 12 (Case 4).—Cast showing extreme wear on the lingual surface of the upper central and lateral incisors. In this patient, a woman, aged 70, there was no pyorrhea although a driving traumatic occlusion had been present for forty years. The first molars were extracted when the patient was 30.

In the first six cases, there was traumatic occlusion of various types, without the slightest evidence of bacterial infection in the gingival margins or deep structures about any of the teeth. The use of revealing stain showed further that the necks of the teeth were comparatively free from bacterial masses, owing to the fact that these patients had habitually scoured the necks of these teeth so that there was a very meager amount of bacterial growth on them at the gingival margin. The fact that cases of the type of Case 7 are numerous and easily demonstrated is further evidence that it is not normal occlusion or malocclusion that governs the occurrence of pyorrhea; rather, it is the heavy growth of bacteria on the teeth, which are protected from the scouring action of foods by the broad overhanging crowns and contact points, and are thus enabled to accumulate and invade the gingivae unopposed.

It is a fundamental truth that good food increases vitality, strength and ability to resist disease. But we cannot depend on this factor alone, because we are constantly meeting people on an apparently perfect dietary who have pronounced pyorrhea. In fact, I note that some of the most vigorous advocates of diet to control mouth disease have not prevented the loss of their teeth. The case described herewith, which can be duplicated at least once a day in active practice, shows that we cannot depend on diet alone to prevent pyorrhea.

CASE 8.—A girl, aged 16, above the average height, splendidly developed, in excellent health, with teeth in good condition and in normal occlusion, on a dietary containing a larger bulk of leafy-top vegetables and citrous fruits than usual and of salads made of cabbage, sliced raw carrots, lettuce, notwithstanding presented deep ulcerating pockets between the first and second molars, the surfaces of which showed a heavy growth of bacteria when stained. A daily scouring of the tooth surfaces, together with the application of alternating light and heavy pressure on the swollen gingivae, thereby removing the bacterial masses and inflammatory exudate, and improving the blood circulation to the gingival margins, resulted in rapid healing of the ulcers and disappearance of the edema.

Fig. 13 (Case 5).—Models of case. In this patient, a woman, aged 77, there was no pyorrhea and the tissues were free from inflammation although traumatic occlusion was life long.

Deposits on the sides of the roots must be removed without injury to the cementum. It is a great mistake to expose cementoblasts to infection by overscraping of the root surfaces. (Figs. 16 and 17.)

HEALING OF GINGIVAL CREVICE

The gingival crevice, when denuded of its epithelial covering, is re-covered with new epithelium about seven days after the continuous active ingress of bacteria is stopped. (Fig. 4.) New epithelium will not extend itself deeper into a pyorrhea pocket than the normal depth of its original gingival crevice. (Fig. 2.) Therefore, when destruction of bone and periodontal membrane has occurred, thus creating lesions deeper than the ordinary depth of the gingival crevice, the tooth surfaces must be scoured clean, and in so doing as heavy pressure should be made on the edges of the loosened tissues with the sides of the toothbrush bristles as possible. This will cause rapid shrinkage of the loosened tissue, often decreasing the depth of the lesion to a point where the gingival epithelium will extend to the bottom and completely cover it, thus making it unnecessary to cut away any of the gum to insure healing, with the great advantage that the tooth root has retained the greatest possible amount of its covering. If the squeezing and scouring process does not shrink the edematous, loosened tissue to a degree that will enable the epithelium completely to cover again the gingival crevice, enough of it should be cut away to reduce the pocket to the extent that the gingival epithelium will be enabled to reach the bottom of the crevice, per-

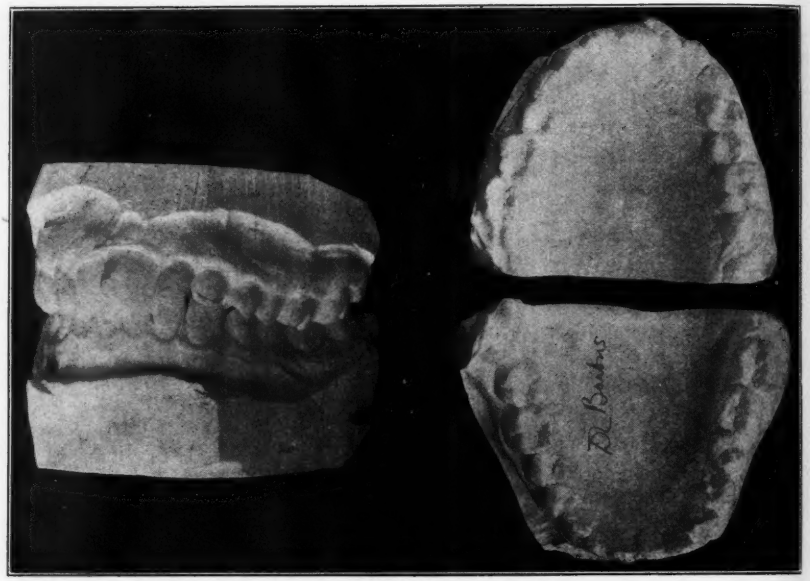


Fig. 14 (Case 6).—Models of Dr. Barber's case. This patient was cured by removal of deposits and vigorous use of the toothbrush.

fect healing being thus induced. If this routine is followed, it will be found that only a comparatively small amount of tissue need be sacrificed in order to assure complete healing.

Drugs have little place in pyorrhea treatment. Vaccines and serums have

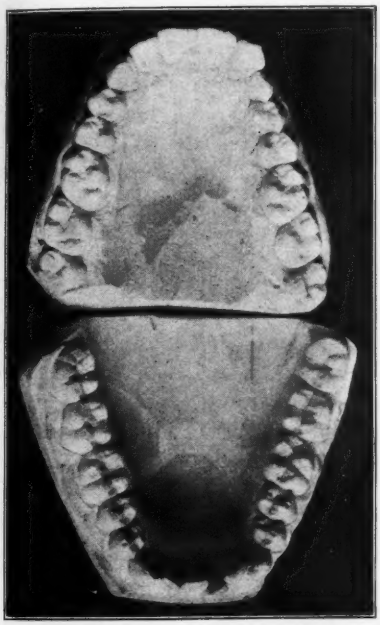


Fig. 15 (Case 7).—Models of case. There are deep pyorrhea pockets in the presence of splendid arrangement and perfect occlusion.

proved almost useless because they do not produce immunity to nor prevent bacterial growth. Our best weapons are cleanliness and proper food. In recent cases, healing has been hastened to some degree by introducing into the deeper pocket an oxidizing agent (derived from sulphuric acid and cresol, united by means of a suitable catalyst). This causes the oxidation and dissolution of granulomatous tissue without injury to normal tissue cells, which is a distinct advantage. When this technic

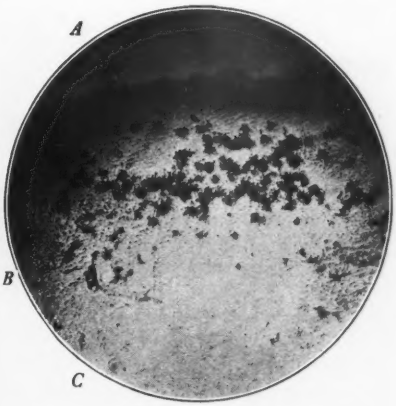


Fig. 16.—Section of root surface: *A*, uncleaned root surface; *B*, area cut deeply enough to expose cementoblasts; *C*, area properly cleansed.

Fig. 17.—Area out of center of section shown in Figure 16, showing cementoblasts exposed by too deep cutting (× 600). When the root is over scraped, exposing the cementum to infection, the root surface from that time on is a center of infection and the tooth may as well be extracted.

is utilized, the oxidizing agent should be carefully placed in the pocket, allowed to act for two minutes and then quick method of destroying bacteria and granulomatous tissue was first suggested by Dr. Lawrence.

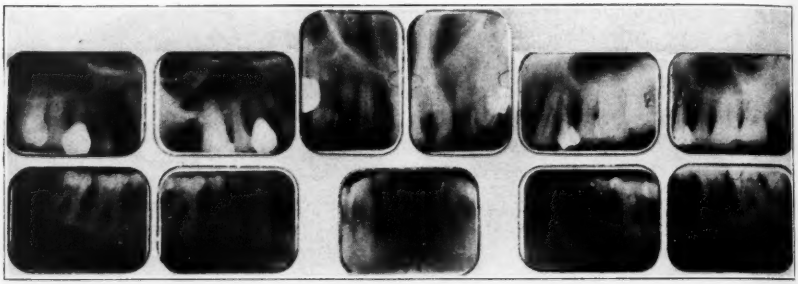


Fig. 18.—Teeth that were still solid and firm after three years, owing to heavy scouring and friction on the gums.

neutralized with saturated solution of sodium bicarbonate. This painless,

Fig. 19.—Stained bacterial mass on sides of recently extracted tooth, this mass being covered by tissue to the enamel margin. The actual depth of the ulcerating pocket is nearly one-half inch. The germs migrate into the tissue, as shown in Figures 6 and 7.

Disclosing stains that reveal to the patient the bacterial masses on the teeth are a necessity. Those composed largely of iodin are best, because they not only reveal the bacterial masses, but also help to destroy them. One of the most useful is a composition of iodin, 50 grains,

Fig. 20.—Method of cleaning buccal and proximal surfaces of molars. The bristles are thrust in between the teeth as far as possible, being then pulled out a little way and thrust in again. There are longer bristles on the end of the brush to reach through the molar interspaces.

and zinc iodin and potassium iodid, each 15 grains.

These solids should be pulverized in a mortar with a half ounce of glycerin, then poured into a bottle, after which a half ounce of water should be used to wash the mortar and the water added to the first solution and well shaken. It

Fig. 21.—A "push and pull" brush for use on the back and front surfaces of isolated teeth.

is then ready for application to the teeth and gingivae. It is not only a revealing stain but also a healing astringent to inflamed soft tissues. It may be supplied to the patient to be used on teeth and gingivae twice a week after cleaning, for two purposes: (1) to show the patient when he has failed to cleanse his teeth thoroughly, so that he may try again, and thus complete a perfect cleansing; and (2) to gain the healing astringent action of the solution on the soft tissues.

No one can be cured of pyorrhea who permits great masses of pyogenic bacteria to accumulate and remain undisturbed for hours or days on the tooth surfaces adjacent to the gingivae. Pyorrhea treatment by the dentist who skilfully removes all deposits on the teeth and corrects all malocclusion, and stops there, fails to benefit the patient permanently. These things are but pre-

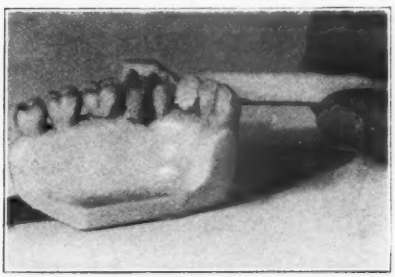


Fig. 22.—Cleaning between teeth; illustrating use of brush shown in Figure 21. The brush is applied to the distal surface of a bicuspid with a pulling movement, which scours the back of the bicuspid; or with a pushing movement, which cleans the front of the molar and at the same time, makes firm pressure on the gingiva.

paratory to the cure, which is wrought by the patient in daily scouring off the continuously growing bacterial mass, together with the emptying of the gingival crevices of pus by squeezing them repeatedly during the scouring process. The dentist who first trains the patient to do this effectively will cure most of his cases whether he does the other things or not, provided he can actually train the patient to spend ten minutes morning and evening at this task.

Sodium ricinoleate is an exceedingly valuable drug in neutralizing bacterial poisons. It is prepared by boiling caster oil and sodium hydrate together over a water bath. When incorporated in scouring preparations, it detoxifies the bacterial poisons formed by the streptococcus group as well as many other bacteria.[1]

Sodium ricinoleate to the amount of 2 per cent of the total bulk of any scouring preparation that is so compounded that the sodium ricinoleate will

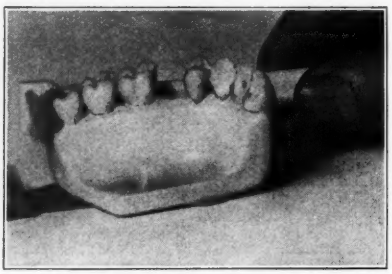


Fig. 23.—Method of cleaning distal surfaces with brush shown in Figure 21.

not be precipitated out of solution is a very material help in the maintenance of germ-free tooth surfaces. Where rapid shrinkage of tissues is indicated and the epithelium is soft and tender, 1 ounce of zinc sulphocarbolate, dissolved in 8 ounces of distilled water to which has been added a few drops of alcoholic solution of oil of cinnamon (first suggested by Dr. Whitslar of Cleveland, years ago)[2] may be used. This should be patted into the tissues with cotton several times daily. It lessens the congestion and causes rapid shrinkage and hardening of the gingivae.

SCOURING

Scouring of tooth surfaces can best be taught to the average individual by

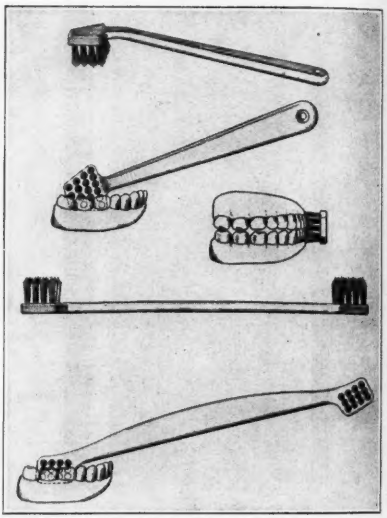


Fig. 24.—Methods of cleaning. The brush shown in the upper three views can be used on both the outside and the inside surfaces; that shown in the two lower views is for cleaning only the inside surfaces.

a demonstration on his own teeth. The first essential is a set of toothbrushes so constructed that all surfaces of all the teeth can be reached. This, of necessity, means that one must possess brushes capable of reaching the lingual, distal and interproximate as well as the buccal

1. Hartzell, T. B., and Larson, W. P.: Neutralization of Bacterial Toxin, J.A.D.A., 12: 271 (March) 1925. Antidiphtheric Immunization Using Sodium Ricinoleate as a Detoxifying Agent, Proc. Soc. Exper. Biol. and Med., 22 (May) 1925. Preparation of Pure Sodium Ricinoleate, Proc. Soc. Exper. Biol. and Med., 22: 553 (May) 1925.

2. Personal communication to the author.

surfaces. Most all toothbrushes seem to have been planned for scouring only the convex surfaces of the teeth, and these surfaces need scouring least of all because they are reached by foods in the act of mastication and are thus kept moderately free from bacteria. Destruction of the tissues in pyorrhea begins in the gingival crevice by the solution of the protecting epithelium lining it, through the action of the ferments created by pyogenic bacteria. The heavier masses collect between the teeth and on the necks of the teeth that are protected from friction of foods, during mastication by the bulbous crowns, the bacterial mass accumulating on the necks of the teeth remaining undisturbed. The bacterial mass first attacks the epithelium in the gingival crevice, digesting this, and then gains access to the tissues. This invasion usually takes place over many months, a chronic inflammation being maintained. The gums become swollen and edematous and the circulation is impaired, the invading bacteria colonizing in these tissues, as shown in Figures 6 and 7.

Fig. 25.—Brush used for cleaning lingual surfaces. This brush is made broad to reach the gingiva with equal pressure with tip and heel.

The end to be attained demands brushes with stiff bristles that can be pushed in between the teeth tightly enough to wedge, so that the scouring movement can be accomplished by a slight backward and forward motion of the handle of the brush, pulling out a little way and thrusting in a little way without pricking the soft tissues. Experience has shown that these bristle tufts should be at least one-eighth inch apart and should vary in length according to the width of the different teeth from buccal to lingual. Bristles that must reach through the embrasures between the molar teeth should be of greater length than is required to reach through and scour the proximate surfaces of incisors.

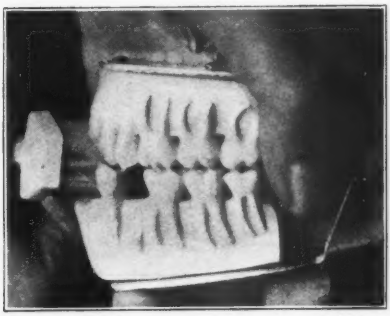


Fig. 26.—Cleaning technic (outside), with brush shown in Figure 25.

I have devised, for my own use, a small series of brushes (Figs. 20-28) from which I select for each patient those best suited to his needs, always supplying enough of them so that he never need use a brush after the saliva has softened it. This is important, since bristles that have been wet for some time in water or saliva are almost useless because they are too soft to scour. I direct all patients to cease the use of a toothbrush when the bristles become soft, and to wash out the brush thoroughly with soap and water, then dip it in common salt water brine, and allow it to dry out, when it will again become stiff.

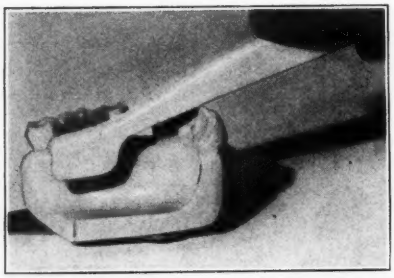


Fig. 27.—Method of cleaning lingual surfaces (inside brush).

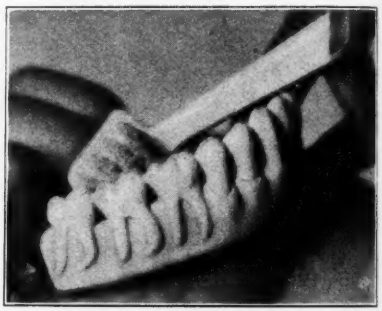


Fig. 28.—Method of cleaning lingual surfaces, employing another type of inside brush.

For buccal surfaces, a small brush (Fig. 20) with the knots of bristles so spaced and trimmed as to admit of easy insertion between the teeth is used. The bristles are made to lean against the cutting edges of the teeth and are curved slightly, the bristles being slowly pressed down in this curved position until they rest on the edge of the gingiva but curved away from the edge, so they will not prick it (Fig. 21). Then the bristles are thrust between the teeth as tightly as the strength of the hand will permit (Fig. 22), and the handle is moved back and forth about a quarter of an inch, the wedged bristles thus being rubbed back and forth against the proximate surfaces of the teeth, at the same time, squeezing the edge of the gingiva with every movement. By the pressure of the sides of the stiff toothbrush bristles against the gingivae, the gingival crevice is for the moment lessened in depth and at the same time the to and fro movement of the bristles scours the previously unexposed tooth surface. No harm is ever done to the gingival edge by this pressure. On the contrary, the tissues of the gingival edge are hardened and the circulation is improved thereby. The same thing should be done on the lingual tooth surfaces. Because of the difficulty in attaining this technic with a straight brush on the lingual surfaces, I have devised two or three simple forms (Figs. 24, 25, 27 and 28) adapted for scouring the inside of the dental arch and compressing the gums between the teeth with the

same degree of efficiency that can be attained with the ordinary straight brush on the buccal and labial surfaces.

The use of these odd toothbrush forms must be taught to each individual. (Figs. 21, 22 and 23.) Take, for instance, the case of a patient who has lost a first molar: the mesial surface of such an isolated tooth will not, by all the ordinary means of scouring, be swept free of its accumulated bacterial mass, and, for that reason, deep pyorrhea pockets form under the overhanging broad mesial surface of the molar, slowly extending themselves toward the root end. The patient should be taught to remove this mass by taking a small brush with the bristles so placed that they fit around the bulge of the crown and make firm pressure against the mesial surface and gum of the second molar when pushed against it. By a pulling movement, the same brush may be used to scour the distal surface of the second bicuspid. There is no reason why the possessor of teeth should not look after each one of them with as much care, himself, as he expects of his dentist. Good dentistry presupposes that the dentist will give attention to every tooth in the denture, and he may be called on to spend hours in the treatment or repair of a single tooth. Is it not just as important that the individual owning the teeth should take special care to keep each individual tooth in such condition that disease of the gingival margin or the enamel surface is made impossible? When our patients learn that they can prevent not only pyorrhea but caries as well, by spending from ten to twenty minutes a day in the care of their teeth, they are ready and willing to follow this method, whereby they preserve not only the health of the teeth, themselves, but of the tissues investing the teeth, and by so doing prevent the occurrence of many death-dealing lesions of the heart, joint and kidney.

BUCKLEY-PRICE DEBATE

(Before the Odontographic Society of Chicago, Oct. 12, 1925)

SUBJECT:

RESOLVED, THAT PRACTICALLY ALL INFECTED PULPLESS TEETH SHOULD BE REMOVED*

Affirmative by WESTON A. PRICE, D.D.S., M.S., F.A.C.D., Cleveland, Ohio

Dr. Johnson, Chairman, Dr. Goslee, President of the Odontographic Society, Dr. Buckley, my worthy opponent in this debate, Ladies and Gentlemen:

IN accepting Dr. Buckley's challenge to meet him in debate on the question—"Resolved, that practically all infected pulpless teeth should be removed"—I have been controlled by a sense of responsibility to humanity, for I believe with all my heart that humanity needs rescuing, not from a wilful aggressor but from an incorrect interpretation which has furnished wrong fundamentals for diagnosis, prognosis and treatment.

I shall probably surprise my opponent and perhaps shock some of my audience when I confess that I hope he will win this debate by furnishing what I have not been able to find: namely, a means for sterilizing and for maintaining sterility of the infected pulpless tooth. I have searched diligently for the same for more than thirty years.

Five hundred and thirty-three years ago today, Columbus proved what the world had thought impossible—namely, that the earth was round, not flat—by the discovery of America. It certainly had seemed proof enough that anyone could see that it was flat. But Newton had discovered and propounded the newly found law of gravitation, by which objects could remain on the surface of the revolving earth. This new truth was a new sense to Columbus, and he conscientiously sailed westward, knowing he must find land or circumnavigate the earth.

Please note that some people to this day, after these centuries of circumnavigation, still believe that the earth is flat, and you have a neighbor city as a suburb of this city that still believes and teaches that the earth is flat, and there are many in the dental profession who still believe that the earth is flat.

If I could have my choice of subject this evening, it would be to discuss the new data, which relate to the cause and prevention of dental caries; for when we have solved that problem, we shall have largely solved the pulpless tooth problem by preventing it.

A new truth is a new sense simply

*The challenge to debate this question was issued by Dr. Buckley and promptly accepted by Dr. Price.

because, with it, we can see things that we could not see before and that others cannot see who do not have that new truth; but a new truth can come only to a prepared mind. I am not here to take issue or to criticize the boasted perfection of art, engineering and mechanical skill in the practice of dentistry; but I shall take a very certain stand in opposition to the current ignorance as to where they should be utilized.

It is not in any spirit of personal criticism that I shall directly or by inference take issue with the judgment of either my distinguished opponent or the many distinguished leaders of our profession, though I shall speak frankly and plainly regarding what I believe to be serious errors of interpretation.

I believe that "practically all infected pulpless teeth should be removed" both because many of the things that we have thought we have understood are not as we have thought them to be, and also because there is a universe of new truth now available which compels a change in orientation and attitude toward the infected pulpless tooth. I refer to the newer knowledge regarding the rôle of focal infections in injuring immunity.

For those who may not understand my relation to this newer data, I shall perhaps be justified in stating that for more than thirty years I have maintained a private staff of workers, assisting me in the details of my investigations in my private research laboratories. (My private work is not now and never has been connected directly or indirectly with that of the American Dental Association, although for seven years I gave about half my time gratuitously to directing their work.)

These intensive studies have included not only investigations of the premises upon which former practice has been based, but also a very extensive investigation through means of blood chemistry and various other applications of biologic science to the study of the various aspects of these problems, both in human beings and in experimental animals; including more than 1,100 chemical analyses of the blood of human beings, many normal, but chiefly affected individuals, and studies of the blood of approximately an equal number of animals.

I shall accordingly spend a little time discussing why I think the old interpretations are inadequate, but shall desire to use most of my time in discussing and presenting the newer knowledge of metabolism, which so completely transcends in importance our preconceived notions that, for those who are able, because of prepared minds, it seems inevitable that it must become a new and controlling truth.

Incidentally, I find it takes six lectures of an hour and a half each to cover in even a general way these newer data. It will clearly, therefore, be entirely impossible for me adequately to present the matter in the minutes at our disposal.

My problem, therefore, will be divided into, first, a group of reasons why we cannot do what we thought we could, and, second, a group of reasons why we should not undertake to. My general outline of approach to the problem will be as follows:

OUTLINE OF AFFIRMATIVE

Evidence indicates that

1. The present very high death rate from degenerative diseases is due in part

to unwise treatment and retention of infected pulpless teeth.

2. It is so difficult as to be practically impossible to sterilize infected cementum in the mouth.

3. Individuals are so very different in their susceptibility to and defense against destructive degenerative diseases as to require different consideration and treatment.

4. The new evidence from blood chemistry reveals that the toxic substances from infected teeth can and do destroy the body's normal defenses and these seriously disturb or destroy function.

With regard to the first, I shall ask you to see what Dr. Livingston Farrand had to say to the American Association for the Advancement of Science at the December meeting, 1922, at Boston, from which address *Science* reported as follows:

> Dr. Farrand reviewed the progress of public health work in this country and pointed out that since 1870 the average length of life has been increased by fifteen years, that marked reduction has occurred during this period in infant mortality and in mortality due to tuberculosis, typhoid, smallpox, and many other diseases. The efforts of health workers and organizations have, however, been unable thus far to prevent increases in certain unconquered diseases, such as cancer and diseases of the heart and kidneys. The most outstanding problem at present concerns the control of the degenerative diseases of later life, an increase in mortality from these being an inevitable consequence of improvements in the control of diseases of infancy and youth.

We can get important help from the statistical researches of the Metropolitan Life Insurance Company. Dr. Haley Fiske, president, says in the *Outlook*, Jan. 30, 1924: "It has been estimated that 2% of the population of the U. S., or more than 2,000,000, have organic heart disease. . . . The annual death toll of heart disease in the U. S. is 150,000."

Few of the students of these problems of the world have a better right to speak, because of both long years of intensive study and an unusual opportunity in the largest clinic in the world, than has Dr. Charles Mayo. He is quoted (*Lancet*, June 13, 1925) as stating, in a London address: "In America there had recently been a tremendous increase in heart disease and in infections, and post-mortem examination seemed to show that much of this was fundamentally due to the teeth."

It is my personal belief that one of the strongest arguments to be brought at this time will be the death rate statistics for various communities, some of which have had for some time not only a conviction, but also a principle of practice for a number of years in a continually enlarging group of members of the dental profession, and these local communities have been quite largely influenced by the local teachings of the dental institutions furnishing the profession for these communities, and further influenced, and perhaps even more largely, by the development of study clubs, which have been taking up the pathologic, and therefore basic, rather than the technical problems of dental practice.

I have accordingly secured from the officers of various communities a detailed statement relative to the actual number of deaths from each of the principal causes, and have assembled these in chart form for your information. Will you please note (Table 1) that in Minneapolis, in whose state institution for the teaching of the art and science of dentistry root-filling has not

been taught for six years, and where the entire community has been both directly and indirectly influenced by that advanced position, the death rate percentage of heart disease has been, in 1923, 13.1, and, in 1924, 12.4; in Iowa, which has been conspicuous for its study clubs and for men with prepared minds: 1923, 8.2, 1922, 8.1; Cleveland, 11.6, 1923, 12.0, 1924; Detroit, 10.4, 1923, 10.7, 1924; Chicago, 16.5, 1923, 17.0, 1924; New York City, 21.5, 1923, 22.2, 1924; Brookline, Mass., 23.8, 1923, 29.0, 1924.

I recently asked a manufacturer of dental broaches how the present sale of them compared with former sales, and his reply indicated that they were still being sold in localized districts. I have also recently communicated with the vice-president of the Ransom & Randolph Co., regarding this matter, and he has kindly given me permission to quote from his reply:

> In response to your inquiry concerning the sale of broaches and root-filling materials, in the territory covered by our various houses—Ohio, Michigan, and Indiana—there has been a very decided falling off on the sale of broaches in recent years, particularly during the past five years. As an estimate, I would say there are not more than one-third of the broaches sold at present, that there were a decade ago.

TABLE 1.—PRINCIPAL CAUSES OF DEATH FROM DEGENERATIVE DISEASES.

Diseases	New York City		Brookline Mass.		Chicago Ill.		Minneapolis Minn.		Cleveland Ohio		Detroit Mich.		Salt Lake City	
	1923	1924	1923	1924	1923	1924	1923	1924	1923	1924	1923	1924	1923	
	Per Cent		Per Cent		Per Cent		Per Cent		Per Cent		Per Cent		Per Cent	
Heart disease	21.5	22.2	23.8	29.0	16.5	17.1	13.2	12.4	11.7	12.0	10.4	10.7	12.6	
Cerebral hemorrhage	0.6	1.0	12.1	8.3	5.1	5.6	6.3	6.0	7.6	7.4	4.4	5.0	6.5	
Cancer	9.0	9.2	11.9	20.4	8.6	9.6	11.4	11.7	8.2	8.0	6.1	6.9	7.0	
Pneumonia & influenza	13.6	13.6	9.3	6.3	12.4	9.4	8.9	7.8	13.6	12.6	16.0	12.4	11.6	
Arterial diseases	4.7	5.1	5.5	4.0	1.0	1.2	2.0	2.3	1.5	2.0	1.1	1.0	0.8	
Kidney diseases	6.3	5.2	4.7	5.8	8.1	9.8	5.2	4.7	6.8	7.1	5.1	4.0	6.2	
Diabetes	2.0	1.7	3.5	1.1	1.9	1.4	1.9	2.0	1.7	1.6	1.3	1.1	1.7	
Tuberculosis, all forms	8.3	8.0	2.1	4.3	6.9	7.4	7.4	6.1	8.1	8.0	7.8	8.8	3.9	
All other causes	34.0	34.0	27.1	20.8	39.5	38.5	43.7	47.0	40.8	41.3	47.8	49.2	49.7	

When we realize that the annual deaths from heart disease for all of England and Wales is about 10.5 per cent of all deaths, and that more than one out of five of the funerals in New York City and Brookline follows a heart case, and one in six in Chicago, as compared with many otherwise comparable communities, we are confronted with a very grave responsibility; for just as tuberculosis has been greatly reduced as an arch slayer, so should and will heart disease be in my belief, when we come to understand and put into practice programs that will eliminate many of the contributing factors.

I cannot state how many of the cases

of death in these cities were directly caused by dental infections, but I am compelled to believe that it runs into tens of thousands. The great trouble is, we do not have a conviction and tide of public sentiment. Things are taken to be what they seem to be, not for what they really are. We are, with regard to heart conditions, where as many communities were with epidemic scourges in the past, and the lines penned by Ross, as his heart was breaking in the realization of the scourge of malaria, are applicable to this today in most of our supposedly civilized communities:

> The painful faces asked, can we not cure?
> We answer, No, not yet; we seek the laws.
> O God, reveal thro' all this thing obscure
> The unseen, small, but million-murdering cause.

How much dental infection does it take to ruin a heart in an individual who is susceptible, or, if it has elective localization qualities, even in an animal without special susceptibility? Figure 1 shows the heart of a rabbit that died from endocarditis and reveals a vegetation an inch long produced by injecting into the rabbit the practically clear washings of two crushed teeth that had been extracted from a man, 26 years of age, suffering with acute endocarditis. The quantity of organisms was calculated by a counting method and found to be less than a millionth part of a gram.

In another case, cultures from the tooth of a boy suffering from acute endocarditis and rheumatism were inoculated into thirty rabbits. Twenty-eight of the thirty rabbits, or 93 per cent, developed acute heart involvement, and thirty of the thirty, or 100 per cent, developed acute rheumatism. This boy died a few months later. He, as we will see, was practically doomed before he was born, for he had by inheritance a marked susceptibility for heart involvement, and he was born in an age and in a community that did not yet have sufficient new truth to protect him against his preventable but impending doom. It would be fortunate if an entire hour could be given to the citing of such specific heart cases.

Similarly, we should note the relation of certain types of arthritis to dental

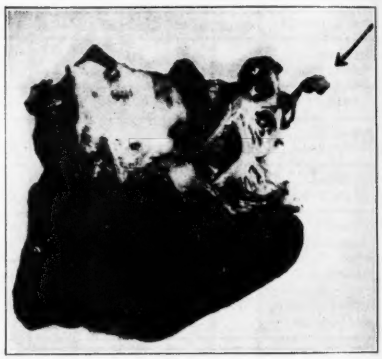


Fig. 1.—Valvular vegetation in heart of rabbit which died of endocarditis after being inoculated with washings of two crushed teeth from a patient suffering from acute endocarditis.

infections. Sir William Willcox and Dr. Beddard of England state: "Ninety per cent of the cases of non-specific infective arthritis are due to infections arising from the teeth." And regarding the prevalence of this type, Ely of San Francisco states: "In the orthopedic clinic at Stanford it is by far the most frequent disease with which we have to deal. Established always with the roentgen rays, its diagnosis comprises more than one-tenth of the diagnoses in our clinic."

Similarly, we should review, if time

permitted, certain affections of eyes, kidneys, nervous system, etc.

Second: It is so difficult as to be practically impossible to sterilize infected cementum in the mouth.*

Our second division presumes that infected teeth can be sterilized. After more than thirty years of investigation on this problem, I am compelled to state my belief that the number of instances (and I shall present evidence supporting them) in which infected teeth have been completely sterilized would be less than five in 100, to say nothing of the difficulty of keeping them sterile.

At this point, I wish in all kindness, but in complete frankness, to state that I am not in accord with advertising propaganda that would make these procedures seem easy and safe for the members of the dental profession, as I will show that I cannot, by any means that has been known to me, succeed in sterilizing infected cementum by treating it through the dentin. I know full well that there are many men perfectly convinced in their own minds that they can do this thing.

Dec. 17, 1922, I received a letter from Dr. Davis, from the office of the director of the Caulk Dental Research Institute, Milford, Del., in which he stated:

> In so far as I have been able to test out any materials I have not been able as yet to sterilize the cementum within the mouth, even though I applied them sufficiently strong to destroy the surrounding tissues.

I quote herewith Dr. Davis' telegram dated Oct. 8, 1925, authorizing me to use this information and giving the results of his further studies:

> You may quote from my letter as requested. No evidence as yet to change that view. Open to conviction. Hope for day when therapeutics will destroy deeply embedded anaerobic infections. Till then physicians and dentists must resort to surgery. Still experimenting.

The infected pulpless tooth, with which we are starting as a premise, is an infected sequestrum so far as all those structures are concerned which are infected. We are immediately then confronted with the problem as to whether or not we can sterilize it and whether or not it will stay sterile. While I could readily take the entire time for this and many others of the single problems involved, I can present only about one or two slides as typical of each problem.

When sterile J. & J. absorbent points carrying the medicament were placed in infected teeth, which are the subject of this debate, and the points were removed after periods of time, five, twenty-four, and forty-eight hours, and cut into sections, 1, 2, 3 and 4, numbering from the root apex up, all but one were infected in forty-eight hours, all but three in twenty-four hours, and only four had some efficiency if tested within five hours. In a mouth in which periapical exudate was present and the root tip was immersed in infected culture medium and the disinfectant placed in the pulp canal, practically all dressings were infected in each five, twenty-four and forty-eight hours.

When we remember that a single-rooted tooth has approximately 3 miles of closed canals when we place the dentinal tubuli on end in series, we get some conception of the difficulty of sterilizing even the dentin. In more than 95 per cent of cases in which we have placed a medicament in a canal on a

*See charts, pp. 289 and 291 in Brooks and Price, Footnote 1.

dressing, when the tooth had periapical involvement, we have in forty-eight hours been able to grow cultures from the dressing that was placed in the tooth, regardless of the medicament that was placed on the dressing.

In the foregoing and many other investigations, which have been reported in detail,[1] it is demonstrated that it is extremely difficult to sterilize infected dentin. Even the placing of small pieces of infected dentin in dilutions of solution of formaldehyd U. S. P. and other

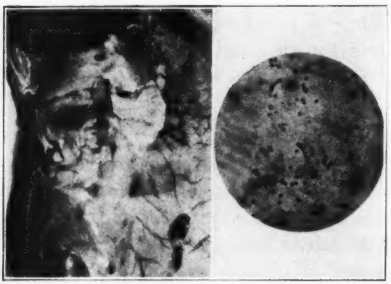


Fig. 2.—Abscess produced in rabbit from supposedly sterilized tooth; also diplococci which grew from same.

medicaments, such as can be used in the mouth, takes considerable time.

The problem becomes very different when it comes to the matter of sterilizing infected cementum by the treatment of infected dentin. For years, I have been not only searching myself for a medicament competent to sterilize tooth structures in the mouth, for I have earnestly wished that this could be accomplished, but also I have been announcing in connection with lectures, as I have gone about the country, a reward of $500 for a means that would accomplish this. After years of study of this problem, I feel sure that I cannot do this by any means that I can safely use in the mouth, and I question very much whether many people have ever spent so much effort in trying to do so.

We have, for example, allowed fuming concentrated solution of formaldehyd to trickle through the pulp canal of a tooth which had the infected cementum protected with a rubber dam above and below, until 10 c.c. had passed through, and the cementum was still infected; for the neutralized tooth was planted beneath the skin of a rabbit under surgical conditions, and an abscess developed containing pure culture of streptococci.

Similarly, we have used silver nitrate neutralized with solution of formaldehyd, giving treatment much more thorough and extreme than could be given in the mouth. The animal under whose skin this tooth was planted died from a large abscess. Figure 2 shows the dissection of the animal and the diplococci which grew out of that tooth after such severe treatment.

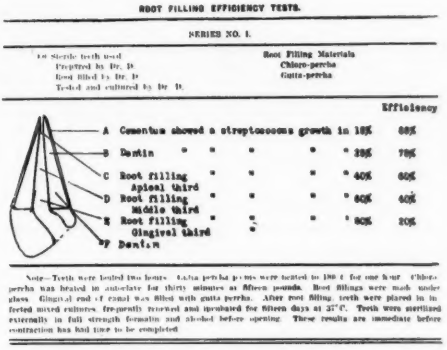
We can visualize the structure of the dentinocemental boundary by thinking of the details involved in the formation of a tooth. The two formative organs, building toward each other, throw down at first a common continuous wall, which is in effect like a bottle or flask, the opening to which is at the root apex. The dentin is built onto the inner side of the bottle and the cementum and enamel on the outer side of the bottle. The dentin has its interior network of channels provided by the retreating odontoblasts as dentinal tubuli formed

1. Brooks, Matilda M., and Price, W. A.: Relative Efficiency of Medicaments for the Sterilization of Tooth Structures, J.N.D.A., 5: 273 (March) 1918. Price, W. A.: Dental Infections, Oral and Systemic (Vol. 1) Chap. 14.

by the protoplasmic cellular extensions from the dentin. The cementum is built around the cementoblasts, which form the lacunae of the cementum, and these included cells are connected with other cells by protoplasmic structures which constitute the canaliculi.

The impervious nature of this common boundary, except for the mouths of the bottle, to which we shall compare the apical and other foramina, through which blood vessels pass, has been attack the relatively extensive infection in the lacunae. If, as has been abundantly demonstrated, all the disinfectant that can be put on a root-canal dressing placed in an infected pulp canal of a tooth which has periapical involvement cannot even keep the dressing sterile, how can it sterilize the periapical area and send a concentrated medicament back into the canaliculi to sterilize the lacunae?

The entire problem of whether or


ROOT FILLING EFFICIENCY TESTS.

SERIES NO. I.

	Root Filling Materials Chloro-percha Gutta-percha	
		Efficiency
A	Cementum showed a streptococcus growth in 18%	68%
B	Dentin " " " " " 32%	78%
C	Root filling Apical third " " " " 40%	60%
D	Root filling Middle third " " " " 60%	40%
E	Root filling Gingival third " " " " 80%	20%
F	Dentin	

Note—Teeth were heated two hours. Gutta percha points were heated to 180 C for one hour. Chloro-percha was heated in autoclave for thirty minutes at fifteen pounds. Root fillings were made under glass. Gingival end of canal was filled with gutta percha. After root filling, teeth were placed in infected mixed cultures, frequently removed and incubated for fifteen days at 37° C. Teeth were sterilized externally in full strength formalin and alcohol before opening. These results are immediate before contraction has had time to be completed

Fig. 3.—Limited ability of root fillings to block out streptococcal infection from tooth structures.

abundantly demonstrated by many workers. Silver nitrate, for example, placed in the interior of a tooth stains the dentin but does not stain the cementum. Similarly, silver nitrate placed on the exterior of a tooth stains the cementum but does not stain the dentin. The disinfectant, therefore, that is placed in the dentin of a tooth must, in order that it may reach organisms in canaliculi and lacunae of the cementum, pass through the single or multiple foramina, proceed along the external surface of the tooth to the canaliculi, and then pass inward through hairlike canals to the lacunae and there not infected pulpless teeth should be extracted or may be treated should perhaps be settled right on this fundamental premise; for if this cannot be done, there is no basis for argument. In this connection, I will state that we have passed a concentrated solution of compound A of Table 4 through a pulp chamber from Saturday until Monday without destroying the organisms in the cementum of the tooth being tested.

We come now to the question as to whether or not, even granting for the sake of argument that a tooth can readily be sterilized in the mouth, which I do not grant except for argu-

ment, a root-filling material can block infection from it. I have previously published[2] extended investigations to determine whether or not it is feasible so to fill the root canals in sterile teeth that infection cannot reenter the tooth structure.

Figure 3 shows a series of such tests in which freshly extracted, autoclaved teeth were root-filled by the various methods and then placed in infected culture mediums for definite periods, after which they were cultured in the various structures, with the alarming result that the great majority of the teeth had infection in the dentin of the tooth and many of them in the root-filling material itself in two weeks.

On the presumption that we were not so skilful in the art as others, I selected five dentists with national reputations and submitted to them teeth which, after being extracted, had been placed in plaster-of-Paris blocks and the blocks autoclaved at 30 pounds for half an hour. These blocks were sent to the operators for placing root-fillings by their methods. On receipt of the blocks the teeth were placed in infected culture mediums for two weeks and then cultured in their various structures, and it is pathetic to record that only two teeth in the lot did not grow cultures from root-filling or dentin. (Table 2.) I am sure that the average dental operations of the best operators of the country would not make so good a showing as this, even assuming what I believe to be nearly impossible, that they could sterilize the tooth.

TABLE 2.—TESTS OF EFFICIENCY OF ROOT FILLINGS PLACED IN STERILE TEETH BY FIVE DENTISTS OF REPUTATION.*

Areas	No. 28	No. 4	No. 7	No. 10	No. 2	No. 11	No. 12	No. 13
Cementum	+	+	−	+	+	+	+	+
Dentin of root	+	−	−	+	+	−	+	+
Root filling, apical third	+	+	−	−	+	−	−	+
Root filling, middle third	+	+	−	−	+	−	−	−
Root filling, gingival third	+	−	−	+	+	−	−	+
Dentin, gingival third	+	−	−	+	+	−	−	+

*Freshly extracted teeth were autoclaved in moist plaster blocks and submitted in sterile containers for root-filling. On receipt, they were placed in infected culture mediums for two weeks. +, positive growth.

In connection with the ability of an operator to place a safe root-filling, I wish to present in Figure 4 a series of root-filled teeth with the following history. At an important convention, during the discussion of root-fillings an operator made the statement that he believed that he could fill 95 per cent of molar teeth perfectly to the ends of the roots. He was challenged by a

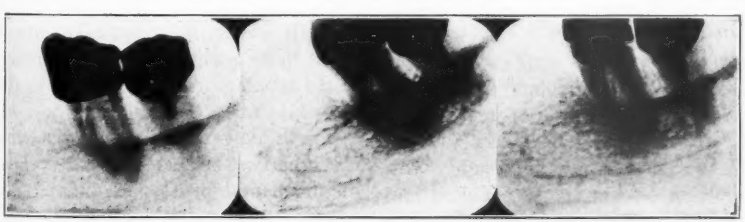
2. Price, W. A.: Dental Infection Oral and Systemic.

confrére from another part of the country, and a bet was made, the outcome of which was that I was to be umpire and furnish No. 1 with a group of molar teeth invested in plaster-of-Paris blocks, the teeth to be returned to me for examination.

The result was most pathetic, for only a small percentage of the roots were filled to the end, but many roots were filled through the sides and some of them for a considerable distance. His explanation of the latter fact was that had the patient, instead of the plaster-of-Paris, been behind the tooth, the pain suffered by the patient would have prevented him from going so far.

In this connection, how many dentists have been filling four canals in the majority of upper first molars? And yet Orton has shown that 75 per cent of upper first molars have four root-canals.†

Fig. 4.—Tragic failure of an expert who had claimed he could fill 95 per cent of molar roots perfectly. Not 5 per cent were efficiently filled; many were filled through the side and many canals were not filled (as usual).



A B C

Fig. 5.—The appearance of two teeth: *A*, before and *B*, after root-filling; and *C*, seventeen months later. (See Table 3.)

Let us take a practical case, studied in another way. Figure 5 shows three

†Walter Hess in Hess and Zürcher says (p. 34): A division of the mesio-buccal canal I could find in only 53 per cent.—Editor.

views of two lower molar teeth. In *A*, we have the condition beneath a gold crown where there was a suspicion that the pulp was degenerating. The pulp was removed and the tooth root filled in our office by an expert, who I believe has skill that is not surpassed. *B* shows the tooth after root-filling, and *C*, the tooth seventeen months later. The patient promised to permit them to be extracted.

The mesial root was then boiled and placed under the skin of a rabbit, and the animal in the next month and a half gained 21 per cent, and was apparently normal. If rabbits could speak, I am sure they would advise boiling as the means for sterilizing infected pulpless teeth.

This whole problem of root sterilization presumes that, when a tooth is made uninhabitable, it will remain so.

TABLE 3.—RESULTS OF IMPLANTATION OF TEETH UNDER SKIN OF RABBITS.*

Before Root filling	After Root filling		17 Months After Root filling
Tooth 31	No. of rabbits	Average days till death	Average loss in weight Per cent
Mesial root†	4	6	20
Distal root	2	30	21

*These teeth are shown in Figure 5.

†The mesial root was then boiled and again implanted. This rabbit gained 21 per cent in six weeks.

On removal, the mesial root of the second molar (showing two root-fillings) was placed under the skin of one rabbit and the distal root under the skin of another (Table 3). These teeth were first washed thoroughly with physiologic sodium chlorid solution and the placing was done with surgical asepsis. Purulent infection developed about each root but much more rapidly about the mesial root than the distal. The mesial root killed four rabbits in succession in an average of six days, with an average loss in weight of 20 per cent. The distal root killed two rabbits in thirty days, with an average loss in weight of 31 per cent.

This, however, does not take into account those qualities which are involved in the adaptability of organisms to their environment. (Tables 4 and 5.)

I will now take up a matter which has great importance for the members of the dental profession; namely, the question of bacterial accommodation. I have previously shown[3] that streptococci have a quality which is characteristic of many other types of organisms of being able to adapt themselves to an unfavorable environment in a way that is most striking. For example: A certain strain of streptococcus requires a dilution

3. Price, W. A.: Dental Infections, Oral and Systemic, Chap. 2.

TABLE 4.—BACTERIAL ACCOMMODATION: ACQUIRED TOLERANCE OF STREPTOCOCCI (FROM DENTAL FOCI) TO VARIOUS MEDICAMENTS.

Strain	Method of Cultivating	Formalin	Formo-cresol	Mercuro-chrome	Trikilin	Lysol	Oxpara	Compound A*	Bat Kallum	Phenol	Creosote	Eucalyptol Compound	Chloroform	Alcohol	Sodium Cacodylate	N-hexyl resorcinol
#43	All dilutions inoculated at once	1-15,000	1-15,000	1-15,000	1-10,000	1-10,000	1-5,000	1-2,500	1- 300	1- 250	1- 200	1- 160	1- 10	1- 10		
#43	Transplants daily 2 days each dilution	1- 5,000	1-25,000	1- 2,500	1- 1,280	1- 400	1-5,000	1- 400	1- 200	1- 225	1- 300	1- 120	1- 35	1- 15		
								Compound A & B† mixed								
#78	Transplants daily 1 tube each dilution							1- 250		1- 500				1- 15	1- 25	
#74	Transplants daily 1 tube each dilution							1-5,000		1- 500				1- 100	1- 100	1-13,000
#92	Transplants daily 1 tube each dilution							1-2,500		1- 500				1- 15	1- 50	1- 7,500
#96	Transplants daily 1 tube each dilution							1- 400		1- 500						1- 7,500

*Compound A is said to contain magnesium chlorid, potassium iodohydrargyrate and water.

†Compound B is said to contain magnesium oxid, barium sulphate, mercurous chlorid and dithymol diiodid.

of 1 to 10,240 in order to begin growth, but with increase in the concentration in medicament came gradually to grow in from 1 to 320. This has been reported for *Spirochaeta pallida* and for the gonococcus. Varieties in the method of culturing produce quite dissimilar results.

The blood fluids bathing an infected tooth contain buffers of remarkable efficiency for neutralizing chemicals. This quality is an essential for life and characterizes all tissues and fluids. One of the culture mediums used was dextrose brain broth which is particularly favorable for the growth of the strains of streptococci found in dental foci.

In Table 4 will be seen the result of using formalin, formocresol, mercurochrome, triolin, lysol, oxpara, compound A (said to contain magnesium chlorid, potassium iodohydrargyrate and water) for two groups, and compound A mixed with compound B, the latter said to contain magnesium oxid, barium sulphate, mercurous chlorid and dithymol diiodid. In that same column, natkalium, phenol, creosote, eucalyptol compound, chloroform, alcohol, sodium cacodylate, and N-hexylresorcinol are listed. Strain 43 is shown by two methods of culture, one in which all dilutions were inoculated at once, and the lowest showing growth was recorded and the other transplants made daily and left two days in each dilution. It will be noted that in many of these substances there was a decrease in the dilutions at which growth was possible, the differences in some cases being as great as 1 to 10,000 for all dilutions not made at once and from 1 to 400 for the daily transplants. You will note particularly the high efficiency of the last drug mentioned, the one recently discussed. Time does not permit of a complete analysis of the fund of information revealed in the chart, which will be readily disclosed to those who make the study.

The question of the method of inoculation is of particular importance since, in the tooth *in situ*, the organisms will find various gradations of conditions which can make their advancement along the lines and in the zones most favorable, owing to the marked neutralizing effect of the body fluids, particularly varied in the infected tooth.

The bacterial accommodation is rapidly diminished. In order to throw light on this phase of the question, we have made inoculations by many different methods, eleven of which are shown in Table 5, which reveals very important new data. In general, the method of rapid transplanting in dextrose brain broth daily gave the most marked changes when compound A or a mixture of A and B was used.

Another important matter has come out of researches on this problem; namely, that there is a great difference in strains of streptococcus. For example, in Table 5 when all strains were inoculated at once, strain 1 grew in 1 to 800 of compound A; strain 43, 1 to 1,250 of A; strain 76 required a dilution of 1 to 10,000 to grow in a mixture of A and B, while strain 61 grew in this mixture in 1 to 600; strain 41 grew in from 1 to 600 A; while strain 69 grew required a dilution of 1 to 1,250 of A. By the rapid daily transplanting method in dextrose brain broth two strains 1 and 32 will be seen growing in from 1 to 160 of A and strain 63 grew in 1 to 100 of a mixture of A and B; strain 96 in from 1 to 300 of A and B; while strain 74 did not grow within this time of experiment lower than in 1 to 5,000

TABLE 5.—ACQUIRED TOLERANCE OR BACTERIAL ACCOMMODATION OF STREPTOCOCCI UNDER VARIOUS EXPERIMENTAL CONDITIONS TO COMPOUND *A** AND COMPOUND *B*†.

COMPOUND	A	A	A+B	A	A	A+B	A	A+B	A+B	A+B	A+B	A+B	A+B	A+B
Strain No.	1	43	76	69	41	61	32	62	63	64	78	74	92	96
All dilutions inoculated at once.	1:800	1:1250	1:10000	1:1250	1:600	1:600								
Rapid transplants in DBB media (daily).	1:160	1:400	1:5000	1:400			1:160	1:600	1:100	1:1250	1:225	1:5000	1:1250	1:300
Rapid transplants in DBB media (anaer)				1:400			1:160							
Inoculated daily, 2 tubes each dilution. 2 days each dilution.		1:400												
Inoculated every 2nd.day. 4 days each dilution.		1:600					1:300							
Inoculated every 2nd. One tube each dilution.	1:40960													
Inoculated every 4th day. One tube each dilution.	1:163840													
Daily. Fresh dilution each day.			1:10000	1:600							1:800	1:10000		
Rapid transplants up to 1:160, then back to 1:200 and on again.							1-180							
Rapid transplants up to 1:600, then back to 1:1250 and on again.							1-250							
Rapid transplants up to 1:300, then back to 1:400 and on again.														

*Said to contain magnesium chlorid, potassium iodohydrargyrate and water.

†Said to contain magnesium oxid, barium sulphate, mercurous chlorid and dithymol diiodid.

of a mixture of A and B. Strain 78 grew in this mixture in 1 to 225. A daily fresh dilution of a mixture of A and B with strain 78 grew in 1 to 800; strain 76 as well grew in a dilution of from 1 to 10,000 of this mixture, which emphasizes the importance of fresh medicaments in infected teeth. The direct application of this information would be to treat the infected teeth daily, indefinitely.

Another important phase of our newer data relates to bacterial mutations under the conditions provided in a medicated tooth. When Rosenow first presented his data indicating mutations, the proposition was not kindly received by most of the leaders of bacteriologic teaching, and I think we may say it is not by some of them today. It is, however, significant that many of the leaders of today are presenting evidence supporting the correctness of his position. To illustrate, Libman, in a paper read before the Michigan State Medical Society, Sept. 11, 1924, states:

> The aerobic streptococci are divided into hemolytic, nonhemolytic, or anhemolytic (so-called *Streptococcus viridans*) and the *Streptococcus mucosus-capsulatus*. The opinion which Dr. Celler and I have had for many years that the anhemolytic streptococci represent transition forms between pneumococci and hemolytic streptococci is now receiving much support.

You will note that Dr. Libman suggests that he and Dr. Celler believe

TABLE 6.—RELATIVE PREVALENCE OF DIFFERENT STRAINS OF STREPTOCOCCI.

Type of Streptococcus*	Per cent	Graphic Expressions
Fecalis	65.5	———————————
Ignavius	1.5	—
Salivarius	1.5	—
Infrequens	9	——
Mitis	7.5	——
Nonhemolyticus I	3	—
Nonhemolyticus III	3	—
Hemolyticus I	3	-
Subacidus	1.5	-
Pyogenes	4.5	—

*Streptococcus viridans is the group name of nonhemolyzing streptococci producing a narrow green zone when grown on blood agar. The first six are viridans. Note that 65 per cent of strains recovered in animals were fecalis.

The total amount of medicaments that can be placed in an infected tooth being too small even to destroy the infection of the tooth readily, as I have shown, we see how complicated the problem becomes of having this medicament maintain concentration in the presence of the body buffers or neutralizing agents sufficiently to continue to destroy streptococci which pass through the circulatory system in swarms each time we catch cold and readily reach the apex of the teeth from gingival pockets about the teeth.

that the anhemolytic streptococci, or viridans group, represent transition forms between pneumococci and hemolytic streptococci. The term viridans is the group name of the nonhemolyzing streptococci which produce a narrow green zone when grown on blood agar.

In Table 6, I have shown nine different strains of streptococci which are frequently found in the mouth, and some of them occasionally, and some frequently, in dental infections. All of the first six, are viridans: namely, fecalis, ignavius, salivarius, infrequens, mitis, nonhemolyticus I, nonhemolyticus III. The last three are not viridans because they hemolyze and do not produce the typical green zone: namely, hemolyticus I, subacidus, pyogenes. (These are called hemolytic strains.)

You will remember that these are different strains of streptococci and in general look alike when seen under the microscope. They are differentiated by their behavior in culture mediums, particularly their ability to ferment certain sugars.

In Table 6, I have shown the relative frequency of these various organisms as they have appeared in the lesions produced or reproduced in animals inoculated with cultures from the teeth of ill patients, and you will kindly note that 65.5 per cent of the strains are the fecalis group, only 1.5 per cent salivarius, and only 7.5 per cent mitus, and the others vary but are all small amounts.

With regard to these various strains, it is very important to note that the usual relatively harmless strain found in the mouth is a salivarius. It is in babies' mouths soon after birth and can be found in most mouths throughout life, and more frequently than other strains in that simple environment. It therefore is most frequently available for the inoculation of dentin and pulps and through the pulp chambers to the tooth structures and apical areas.

Please keep in mind that this is not the strain that we generally found in pure culture in the hearts, joints and other diseased organs of animals in-

TABLE 7.—BACTERIAL MUTATIONS WHICH HAVE DEVELOPED IN THE PRESENCE OF IRRITANTS.*

EFFECT OF VARIOUS MEDICAMENTS ON FERMENTATION QUALITIES DURING ACQUISITION OF TOLERANCE OF STREPTOCOCCI

Medicaments	1:100,000	1:50,000	1:25,000	1:12,500	1:18,000	1:10,000	1:11,000	1:11,500	1:12,000	1:12,500	1:13,000	1:13,500	1:14,000	1:14,500	1:15,000	1:15,500	1:16,000	1:16,500	1:17,000	1:17,500	1:18,000	1:18,500	1:19,000	1:19,500	1:20,000
Formalin						S																			
Formocresol						S		M			M														
Mercurochrome						S																			
Triclein						S		M																	
Lysol						S		M			F														
Oxpara						S																			
Oxygen liquid						S		S			F														
Natkalium						S		M			F			F											
Phenol						S		S			S			F											
Creosote						S		M			M														
Eucalyptol Compound						S		S			M			F											
Chloroform						S		M			F			F					F		F				
Alcohol						S		M			F			F					F		F				

Strain No. 43. Salivarius.

*All started as salivarius. Many changed first to mitis and then to fecalis, with an increase in disease-producing power.

oculated with the cultures from the teeth which had been extracted from individuals suffering from acute lesions, which the animals frequently reproduced. As stated, the strain found in 65 per cent of the cases of a series taken in succession was fecalis.

The effect of various medicaments on changing in a test tube the type or strain of the streptococcus in question was interesting. Strain 78, when recovered from the tooth, was a mitus. In sodium cacodylate, it changed to equinus, then to ignavius, then back to

mitus, then to nonhemolyticus III. In alcohol it changed to nonhemolyticus III. In compound A, it changed to nonhemolyticus I. In phenol, it remained a mitus.

Strain 43 (Table 7) was a salivarious to start with and changed in many of the medicaments to a mitus, and in many changed to a fecalis, when it came to grow in an increased concentration of an irritant. Is it not clear that, by submitting the organism to an irritant, we have made it more virulent and more dangerous? Similarly, the behavior of the various strains will be followed through on that chart, which is most illuminating.

Remember a new truth is a new sense because with it we can see things that we could not see before, and this new truth certainly demands that we shall look on a treated tooth in an entirely different light from that in which we have in the past, for not only do we have great difficulty, amounting practically to an impossibility, in completely sterilizing tooth structure, but also our efforts may result in the development of a more virulent organism if we have not exterminated the last one. That, however, is not all the story; for, even though we have sterilized the tooth, it can with a dissipation of its medicaments become reinfected from the blood stream and other sources and will then be the right kind of an incubator to develop a virulent strain.

Haden has shown by a method of culturing which is designed to show the colonies in a special agar medium that 54 per cent of 490 pulpless teeth which were roentgenographically negative grew out colonies, and, under the same procedure, 70 per cent of 425 which were roentgenographically positive. Will you note, please, the small difference whether the teeth were negative or positive roentgenographically? His work has also added much to the literature, demonstrating that the roentgenographically negative tooth is by no means evidence of absence of infection. (It is not at all probable, however, that his alkaline culture medium grew out all the strains present, for many are not so facultative; they require an acid medium.)

Rosenow and Meisser, by taking the cultures from patients suffering from stone in the kidney, were able to produce stone in the kidney in dogs by simply placing those cultures in the pulp canals of devitalized teeth and permitting them to continue to grow there. In spite of the normal defense of the animal's body, a large percentage of the animals had their defense broken, and developed kidney stones; and, further, when teeth were root filled in a sterile manner in normal dogs, they tended to remain sterile for a period but soon became infected if some other tooth or teeth of that animal were filled in an unsterile manner: that is, purposely inoculated. In other words, there was evidence that the infection passed through the supporting medium and the circulation from the infected pulpless tooth to the noninfected pulpless tooth, with the result that the latter became an infected pulpless tooth. There is much evidence that just this thing happens in humans.

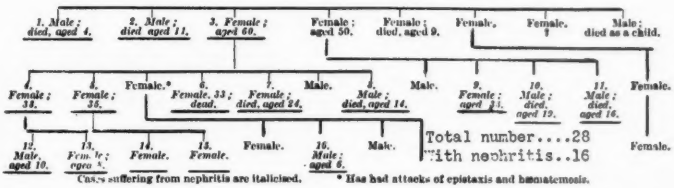
Third: Individuals are so very different in their susceptibility to and defense against destructive degenerative diseases as to require different consideration and treatment.

Dental practice in the past has largely looked on individuals as being sufficiently similar to be comparable with regard to the dental program that

may be indicated for any given dental condition. That some individuals are more susceptible to heart or kidney or joint involvements than are the majority is a fact so abundantly demonstrated in every community that we all have been talking about this and that disease running in this and that family. What we have been seeing is that, by inheritance, there is a lowered resistance for that disease in that family. This should directly influence, and when this new truth has become a new sense in our tooth will produce visible injurious expression in another part of the body.

Table 8, from the *Lancet*, Sept. 27, 1924, presents a report of Drs. Eason, Smith and Buchanan that, in a given family with twenty-eight members, sixteen have developed nephritis, and in their text, they discuss the relationship of the dental infections to the development of these lesions. In the light of our newer knowledge, members of that family should have special consideration regarding their dental care, keep-

TABLE 8.—GENEALOGICAL TREE (HURST)*



*Influence of inheritance on susceptibility to nephritis. In this family of twenty-eight, sixteen developed nephritis; hence, their increased danger from dental infections in the presence of systemic overloads.

profession, will largely determine what operations may and what operations may not be done for particular individuals.

We are also all familiar with the common expression that a draft on the neck, for example, or getting wet, caused rheumatism, or stiff neck, or what not. We have not appreciated the sensitiveness of our bodies to overloads which depress either local or general defense; and yet we are all familiar with the fact that certain affections express themselves when the individual is attacked with an acute or chronic illness. What I wish you to see is that these factors both of inherited susceptibility and of overload may decide whether or not the infected ing in mind this weakness in the wall of normal defense. In my own practice, our families are routinely studied, charted and classified in such a way that we often know before children are born where the inherited weak link in the chain might be expected to be, and such individuals have a program adapted and controlled by that fundamental truth.

This is more clearly demonstrated in Table 9, which shows the result of taking forty individuals, ten with joint involvement, ten with heart involvement, ten with nervous system involvement, and ten with internal organ involvement, and studying the other members of the family, approximately sixteen people for each of the ten fam-

ilies. When we compare the expressions of these lesions in members of the family other than the individuals studied, we find that, in the group where all ten individuals had rheumatism, the other members of that family, approximately 160 in each group, had fifty-nine instances of rheumatism, as compared with twenty-four, fifteen and thirteen in the other three groups. For the heart group, the other members of the family had fifty-seven cases, as compared with seven, nine and nine; nervous system group, 142, as compared with nineteen, twenty-five and thirty; internal organ group, ninety, as compared with nineteen, thirty and twenty-eight.

While the presence of an affection in a parent or ancestor might be argued to

TABLE 9.—DOMINANCE OF SPECIAL TISSUE LESION IN BOTH PATIENTS AND FAMILIES (TEN).

Group	No. of Males	No. of Females	No. of Lesions in Ten Patients							No. of Lesions in Families							Local Expressions of Dental Infections					
																Total						
			Tonsils	Rheumatism	Heart	Neck	Nerves	Internal Organs	Special Tissues	Tonsils	Rheumatism	Heart	Neck	Nerves	Internal Organs	Special Tissues	Severe	Severe & Mild	Caries	Periodontoclasia	Open	Locked	Rarefying	Condensing
Rheumatism	2	8	5	**10**	2	6	4	4	3	8	**59**	7	9	19	19	10	104	131	9	1	1	6	2	3
Heart	3	7	7	6	**10**	5	7	3	8	12	24	**57**	6	25	13	19	121	156	10	1	2	8	3	5
Nerves	2	8	5	6	2	7	**10**	7	7	10	15	9	10	**142**	28	19	180	233	9	3	3	9	5	5
Internal Organs	2	8	6	4	0	6	9	**10**	6	6	13	9	10	30	**90**	12	136	170	7	3	3	7	4	3

Type of susceptibility—inherited.

TABLE 10.—RELATION OF PERIODONTOCLASIA TO SUSCEPTIBILITY TO RHEUMATIC GROUP LESIONS. (FIFTEEN TYPICAL FAMILIES IN EACH GROUP. GROUP TWO).

Susceptibility	No. of lesions per family		Caries	Periodontoclasia
	Severe	Severe and mild	Per cent	Per cent
Absent	16	31	40	40
Acquired	63	96	80	33
Inherited 1 side mild	144	201	67	33
Inherited 2 sides mild	227	308	93	20
Inherited 1 side strong	258	338	80	20
Inherited 2 sides strong	483	754	93	0

have contributed to the development of the lesion in the offspring, it cannot be so argued in these instances since the child could not influence its ancestry. On the basis of susceptibility to the rheumatic group affections, we can, as I have shown (Table 10) divide all people into three groups, absent, acquired and inherited susceptibility. The inherited group we divide into four subgroups, one side mild, two sides mild, one side strong and two sides strong.

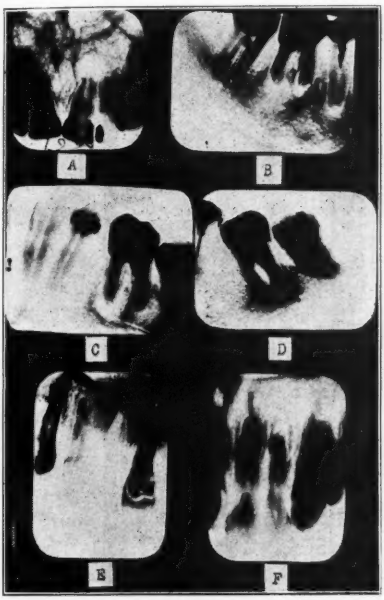


Fig. 6.—Classification of individuals into three groups on the basis of the type of bone change, with a given dental infection.

On this basis, it will be found that, in fifteen families with an average of sixteen people each, the severe rheumatic group lesions in the fifteen families (or an average of 240 people) will be in the absent group sixteen cases, the acquired group sixty-three, inherited one side mild 144, inherited two sides mild 227, inherited one side strong 258, inherited two sides strong 483, where, when we include the severe and mild lesions, the severe being those that will kill or incapacitate and the mild those that will cause to suffer but not seriously injure, the figures are 31, 96, 201, 308, 338, 754. In other words, the individuals in the latter groups have a potential possibility for injury from an adequate source of infection, of which dental infections are the most common and most severe, from twenty to thirty times as great as the individuals in the first group.

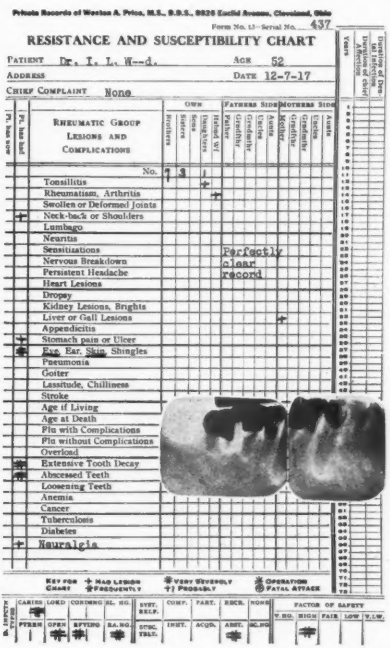
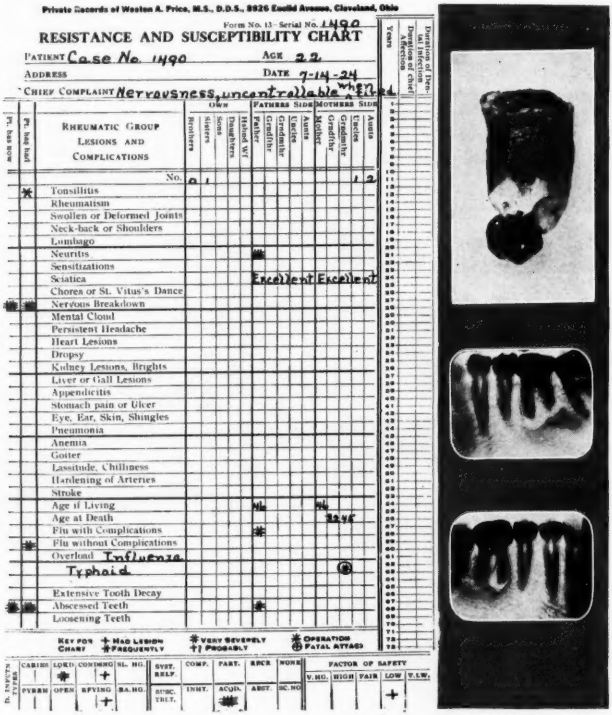


Fig. 7.—Group I, by each of two methods of classification: absent; susceptibility of patient and family, and marked decalcification.

On the basis of dental pathologic processes in relation to local irritants, such as infection, we can again divide all people into three groups: first, those with large areas of rarefaction, as illustrated in A and B of Figure 6; second, those with large areas surrounded by zones of much condensation, C and D; and, third, those who even with much infection, such as all the infection of an infected pulp, have very little rarefaction about the root end, as shown in E and F, and often much condensation, or all the bones are dense.


Private Records of Weston A. Price, M.S., D.D.S., 8926 Euclid Avenue, Cleveland, Ohio

Form No. 13 Serial No. 1490

RESISTANCE AND SUSCEPTIBILITY CHART

PATIENT Case No. 1490 AGE 22

ADDRESS DATE 7-14-24

CHIEF COMPLAINT Nervousness, uncontrollable at times

RHEUMATIC GROUP LESIONS AND COMPLICATIONS

No. 0 1 1 2

Tonsilitis
Rheumatism
Swollen or Deformed Joints
Neck-back or Shoulders
Lumbago
Neuritis
Sensitizations
Sciatica
Chorea or St. Vitus's Dance
Nervous Breakdown
Mental Cloud
Persistent Headache
Heart Lesions
Dropsy
Kidney Lesions, Brights
Liver or Gall Lesions
Appendicitis
Stomach pain or Ulcer
Eye, Ear, Skin, Shingles
Pneumonia
Anemia
Goiter
Lassitude, Chilliness
Hardening of Arteries
Stroke
Age if Living 46 74
Age at Death 1946
Flu with Complications
Flu without Complications
Overload Influenza
Typhoid
Extensive Tooth Decay
Abscessed Teeth
Loosening Teeth

Excellent Excellent

KEY FOR CHART + HAD LESION ‡ VERY SEVERELY ⊕ OPERATION ✱ FREQUENTLY †‖ PROBABLY ✱ FATAL ATTACK

Pt. Teeth CARIES LOCD. CONDMG. SL. HG. SYST. REACT. COMP. PART. REACT. NONE FACTOR OF SAFETY

PYORR OPER. ERVING RA. HG. SUBJC. THET. INHT. ACQD. ABOT. SC. NO V. HG. HIGH FAIR LOW V.LW.

Fig. 8.—Group II, by each of two methods of classification: acquired; susceptibility with overload, and zone of condensation about zone of rarefaction.

When we relate these two factors, we find a typical illustration (Group I, Fig. 7) of a man, 52 years of age, in 1917, now over 60, a member of a large family and practically never sick a day in his life. His only trouble is an eye involvement; he cannot read late as he used to, unaided by glasses, and roentgenograms reveal very extensive decalcification. It is now demonstrated beyond the possibility of question that the individuals who developed a large zone of rarefaction did so at the time when they were able to produce decalcification as a part of a defensive mechanism, and large areas are there-

fore diagnostic that the patient has had in the past, and possibly up to the present, a high defense.

Group II (Fig. 8) relates the individuals with the broken susceptibility, due to overload, with the type of dental pathologic process, the condensing osteitis around the rarefying. In this case, a woman, 22 years of age, who had had influenza, with a nervous breakdown, had experienced a rapid recovery after the removal of her dental infections. Note the zone of calcification around the rarefaction, and also note the effect of overload on an individual who had normally a high defense.

Group III (Fig. 9) is represented by the case of a woman, 24 years of age, who was ill of heart trouble and rheumatism, and whose father and mother both died from heart trouble. There were nine cases of rheumatism and seven of heart disease in the family. The patient was doomed before she was born unless she chanced to live in a community where this new truth had become a new sense: namely, that by keeping free from a source of streptococcal infection she might still, in spite of her handicap, have a relatively comfortable life, provided she kept her overloads reduced. With the removal of the sources of dental infection, she returned to her work, and she has not yet had a second break.

When, now, we relate these important factors to the type of disease that develops in an individual, we find, as shown in Table 11, that those individuals in the inherited susceptibility group have a lower than normal blood active or ionic calcium, and the bactericidal efficiency of their blood is low. They are the group in whom dental pathologic processes are expressed with little rarefaction, and often with considerable condensing osteitis, and the group which suffer from heart, proliferative arthritis, acute rheumatism, caries, kidney involvement, stroke and nervous breakdown.

The second group from the bottom,

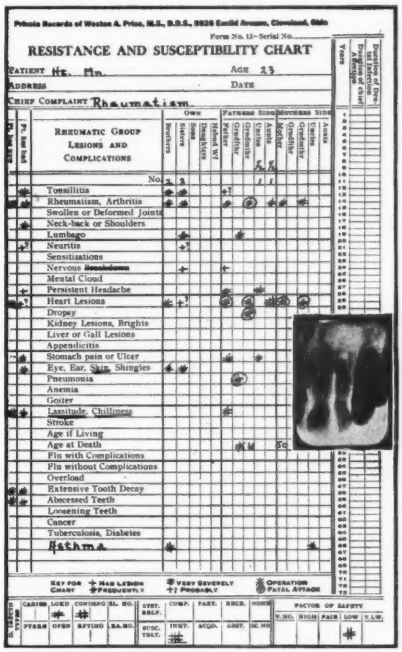


Fig. 9.—Group III, by each of two methods of classification: inherited susceptibility of individual and of family; relatively slight bone change about tooth with putrescent pulp.

or middle group, with the condensing osteitis about an extensive rarefying osteitis as their dental characteristic, have the acquired susceptibility to the rheumatic group lesions, usually because of overloads: pregnancy, influenza or such affection. Their blood ionic cal-

TABLE 11.—RELATION OF CALCIFICATION AND DECALCIFICATION TO TYPE OF SYSTEMIC DISEASE.

| TYPE OF LOCAL REACTION IN BONE | SUSCEPTIBILITY GROUP | BLOOD IONIC CALCIUM | BACTERICIDAL EFFICIENCY OF BLOOD FOR STREPTOCOCCI | SYSTEMIC DISTURBANCES STREPTOCOCCAL AND NONSTREPTOCOCCAL | | |

cium, which is now low, was formerly high. The bactericidal efficiency of the blood is now low, and they of that group now suffer acutely from dental caries. They may have kidney involvement or stroke, nervous breakdown, degenerative arthritis (not proliferative), neuritis, the various sensitizations of the skin or respiratory tract, hay fever, etc.

The people in the upper group with the marked rarefying osteitis without condensing osteitis about it as their dental characteristic have complete absence of susceptibility to the rheumatic group lesions; the blood ionic calcium is normally high; and the bactericidal efficiency of their blood for streptococci is high. This group, while not suffering from the rheumatic types of degenerative diseases, furnishes the individuals who may have the sensitizations, hay fever, asthma, etc., and furnish almost all those with diabetes, tuberculosis, cancer and many of the severe anemias.

Table 12 presents findings in a group of 100 cases studied intensively with regard to the development of cancer, tuberculosis, diabetes, anemia and stroke, in which it will be noted that the percentage of these lesions is low in those individuals who have been suffering from the severe rheumatic group affections, and is high in those who have a history of being free from these affections during their lifetime.

Time does not permit my introducing a quantity of evidence that I should wish to, demonstrating the calcium levels of the individuals of these three groups. I have recently presented these and many related data on the interpretation of calcium in a paper before the American Dental Association, entitled "Newer Knowledge of Calcium Metabolism in Health and Disease, with Special Consideration of Calcification and Decalcification Processes, Including Focal Infection Phenomena," which will be published in THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION in due time. (It should be noted, that Dr. Haven Emerson has recently shown that diabetes has increased in New York City 1,426 per cent since 1866, and that this increase comes almost entirely in the individuals 45 years of age and over.)

Table 13 is a summary made from these charts, showing the average total and active calciums of the individuals in each of the three groups, and it will be noted that both total and active cal-

TABLE 12.—FINDINGS IN STUDY OF 100 CONSECUTIVE FAMILIES*

	No. of Cases in Families	Rheumatic Group Affections					
		Severe		Mild		Absent	
		No.	%	No.	%	No.	%
Tuberculosis	51	6	12	7	14	38	75
Diabetes	15	1	7	3	20	11	73
Anemia	15	6	40	1	7	8	53
Stroke	72	8	11	25	35	39	54
Cancer	45	2	4	11	24	32	71

*Study of association of nonrheumatic group affections with presence or absence of rheumatic group susceptibilities.

cium tends to be high in the group with a high defense characteristic of those classified under absent susceptibility; that in those with a broken defense, or an acquired susceptibility, the total calcium tends to be high, though when the condition is severe is depressed, but the active is quite regularly depressed; and in the third group, those with severe overloads or those with marked inherited susceptibility, both total and active calciums tend to be low.

TABLE 13.—AVERAGE CALCIUM LEVELS OF THREE TYPICAL HEALTH GROUPS OF ELEVEN EACH ON THE BASIS OF BLOOD CHEMISTRY.

Clinical Conditions	Alkalinity Index	Total Calcium	Active Calcium	Inorganic Phosphorus	Total Organic Phosphorus	Total Calcium Balance	Calcium Active Balance	Sugar	Nonprotein Nitrogen	Cholesterol	Total Fats	Fatty Acids
Group I Resistance high; high total-high active	34.3	11.96	10.59	3.2	41.5	-0.3	-4.8	108	27	139	607	511
Group II Mild breaks; high total-low active	33.4	11.25	9.02	3.0	39.5	-5.5	-13.0	139	32	143	689	540
Group III Severe breaks; low total-low active	36.3	9.58	8.07	3.0	58.6	-12.6	-14.6	101	29	112	694	550

A proper discussion of this matter should relate the decalcifying processes, such as we are all familiar with as pyorrhea alveolaris, with their systemic aspects, for we have not adequately realized that these individuals have typical bone characteristics in every part of their body. I do not presume to offer an explanation for the etiology of these metabolism degenerative diseases, but I wish to call your attention to these fundamental basic relationships to the way the individual handles his or her calcium.

It is of particular importance in connection with tuberculosis that those individuals have the losing fight who fail to calcify their tubercles, or who decalcify them if they were calcified; and, conversely, those of us (we are advised by our leading pathologists this includes most human beings) who think we have not had tuberculosis, but who have had and have recovered because we have calcified our tubercles. In connection with cancer and its relation to calcium, I shall later call attention to the fact that, under the stress of depression of the active calcium from infection or otherwise, Nature seems to have a mechanism for dragging that important element up to a higher level by increasing the total calcium.

With this in mind, please note the statement of Dr. Ludwig M. Wolff, sanitary councillor and German cancer specialist, who has recently been quoted in the *Science News Letter*, September 5, as stating, in a discussion regarding the recent announcements of a germ that will produce cancer, that he is in accord with the thought of the group at

Dover, England, which he discusses, saying in part regarding calcium:

> The Dover idea of treatment involves the use of radio-phosphate of potash. This oxidizes the blood and prevents an excess of calcium, that usual phenomenon of middle age, just about the time when cancer begins to rear its head.

In this connection, it is important to quote from Dr. W. M. Crofton of the Royal Academy of Medicine in Ireland:

> It was suggested that the cancer cell was really of the nature of a phorozoon, the normal cell being degraded to this stage as the result of chronic submaximal stimuli and enabled to live owing to a change in the body fluids. Dr. Crofton suggested that in many cases, if not in all, the stimulus was caused by chronic infection with non-pathogenic bacteria.

It is exceedingly difficult to visualize this difference in normal and acquired susceptibility without long and intensive study. The boundaries are not sharply defined. However, I have taken the information that has been accumulated in the intensive study of more than 1,600 charts of families, and I have expressed this in Figure 10, in which will be seen the life and illness expectancy of the three susceptibility groups—absent, acquired, and inherited. The portion left plain white expresses the average period of good health, the portion with the lines represents the period of recurring illness and the portion blackened is the part of 100 years which they of that group have not had the privilege of life.

In the inherited susceptibility group, the lines are vertical. They are chiefly disturbed with the so-called rheumatic group affections. This group constitutes approximately 25 per cent of the total population. The period of recurring illness develops in part of the group under 10 years, in a large number between 10 and 20, and in most of them by 40 years of age. Death starts reaping between 20 and 30, and takes its heavy toll before 50, only a few reaching 70.

The middle group with the acquired susceptibility is by far the largest, constituting about 50 per cent of the population of an average community. They under proper care should remain in the group with absent susceptibility, though they do not have so high a defense. Their breaks are caused largely by overloads, of which influenza and pregnancy are the most frequent. They break with certain of the rheumatic group and certain of the nonrheumatic group affections. Their recurring illness period has begun with most individuals by 50 years of age, and death starts its toll at 45, and often occurs under 55 years of age. In this group, we have placed the lines horizontally.

The third group, or those with the absent susceptibility, is made up largely of those individuals, with whom we are all familiar, who boast that they have never had a sick day in their life. While they do not develop the so-called rheumatic group diseases, they do furnish largely the individuals who make the losing fight with tuberculosis, diabetes and cancer, or die finally of old age. Please note I do not state or imply that tuberculous patients have either diabetes or cancer, that anyone of these affections predisposes to another or that all in this group develop one of these diseases. In this absent susceptibility group, we have many individuals living beyond 90 years of age. The average tenure of life for the individuals of this group is approximately twice that in the inherited susceptibility group, but please note there is a marked difference in the span of life in the different indi-

viduals in the different groups. The lines are placed obliquely for this group. If, now, we shall presume that, because we can find so many dozens, hundreds or thousands of individuals from the last group who have carried root fillings for 10, 25, or 50 years, we have an illustration of what may be expected to happen in all other individuals, we will make a mistake which is tragic in its injustice, and yet is it not just what the profession has been doing largely in the past?

bility should never under any ordinary circumstance have a single root filling, nor should they be allowed to retain one if it is present. They cannot maintain sterility if we could produce it. In spite of everything we can do for them, they will go through life with a tremendous handicap; but just as Eskimos do not die of measles unless they are exposed to measles, just so these may not die from a streptococcal infection if they have not been exposed to strains of the type which will readily

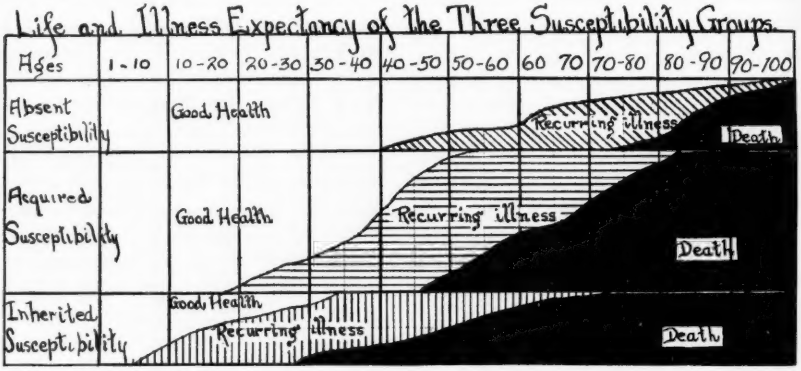


Fig. 10.—Comparison of health and disease expectancy in three different groups.

What I am concerned about is not only the question of the relation of infected teeth to those who are living, but also the question as to the relation of their infected teeth to those who have died. I have not included in this chart the deaths in infancy and from the epidemic diseases of childhood, which would move the age limits much farther to the left. I am in this chart dealing with the individuals who have escaped those handicaps.

I would say, therefore, of the people in these three groups, as illustrated in Figure 10, that those individuals who classify as having an inherited susceptibility should never under any ordinary circumstance have a single root filling, nor should they be allowed to retain one if it is present. They cannot maintain sterility if we could produce it. In spite of everything we can do for them, they will go through life with a tremendous handicap; but just as Eskimos do not die of measles unless they are exposed to measles, just so these may not die from a streptococcal infection if they have not been exposed to strains of the type which will readily produce the lesions to which they are susceptible, and no type of focal infection lesion of the entire body is comparable in danger (because of its mechanical internal and external conditions) to an infected tooth, for the defenses of the body cannot enter the tooth and annihilate the source of toxic and bacterial irritation, nor can Nature absorb the infected dentin sequestrum because of the living cementum about it, which protects it.

The individuals with an acquired susceptibility in the middle group should all, in my judgment, have practically all teeth with root fillings removed by

the time they are 45 to 50 years of age, and just as much sooner than that as their overloads shall tend to depress their physical defense. Do not think you can come to their rescue and remove the endangering tooth just before the attack of influenza or other serious overload. The only time to prepare their bark for the sea of life is when it is in your dry dock, not when the ship is in a storm.

Individuals in the upper group or absent susceptibility constitute approximately 25 per cent of all the people of an average community, but since cancer and diabetes and tuberculosis take such a large toll, we must be very careful not to produce in their bodies conditions which tend to increase their susceptibility to these affections. If, however, root fillings or root resections must be made, they should be limited, if possible, to the individuals of this group. It is my belief that even the individuals of this group should have all pulpless teeth removed before they are 55 years of age.

Fourth: The new evidence on the basis of blood chemistry demonstrates the extremely severe injurious effects of dental infections on the defenses of the body.

As unanswerable as the data herewith presented have been, it is significant that an enormous field of new information has been opened through the medium of the study of the changes of the blood of patients and animals under various conditions in relation to dental and focal infections. In the light of these newer data, we are compelled to look on many, if not most, of the degenerative diseases as symptoms and end results of fundamental systemic changes produced in the body by various contributing factors, an important one of which has been focal infection, chiefly from the teeth. It is my belief that these constitute by far the most important argument against temporizing with dental infection. I do not come to you with hearsay or largely quotations, but from a great fund of evidence that has developed directly under my direction, and I therefore speak first hand, and I believe the evidence will speak for itself.

Patients with chronic dental infections have been considered safe or in

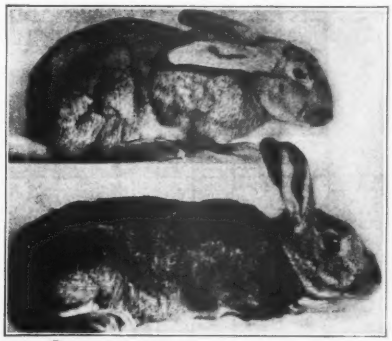


Fig. 11.—These rabbits are brothers. The upper, which was innoculated with the washings of a crushed, infected tooth, lost 35 per cent in weight, while the control gained 15 per cent.

danger in accordance with the apparent evidence of a serious lesion in heart, kidney, joints or elsewhere, provided it could and had been demonstrated that there was no possibility of focal infection coming from any other part of the body. Then and then only might the dental infections be condemned in the minds of many operators.

That this point of view is not based upon any great truth but is the confidence inspired by ignorance can be abundantly demonstrated. When the crushed infected tooth is washed in

physiologic sodium chlorid solution and the relatively clear washings are inoculated into the ear vein of a rabbit, even after the removal of all débris, there is often produced in the animal a progressive series of changes, which find their expression chiefly in blood constituents and their proportions together with a loss in weight and frequently with marked marasmus. It should be noted that there will generally be no localized symptoms as heart, kidney or joint involvement.

That this is not necessarily chiefly due to bacterial content can be demonstrated by a production of even severe expressions with tooth washings that had been put through a Berkfeld filter. Figure 11 shows two rabbits, the upper one of which was inoculated, in its ear vein, with the crushed washings of an infected tooth. It lost 35 per cent in weight in five weeks, while its brother gained 15 per cent in weight.

When we study the blood stream changes, we find that quite similar symptoms are produced in animals if the infected tooth, instead of being crushed and its washings injected, is itself passed through a buttonhole incision underneath the skin and the wound closed by proper surgical procedure. Table 14 presents findings in a series of such rabbits, and it will be noted that in each as the animal lost in weight (more in some than a third) there was a progressive depression in the percentage of polymorphonuclears, with a corresponding increase in the number of small lymphocytes. Something was taking place in the animal's body which was destroying its ability to fight its own infection. This decrease in polymorphonuclears amounted to 17 per

TABLE 14.—TYPICAL BLOOD PICTURE IN CERTAIN TYPES OF CHRONIC DENTAL INFECTION

Case No.	Rabbit No.	Weight Actual	Weight Loss %		Hemoglobin	Erythrocytes	Leucocytes	Polymorphonuclears %	Lymphocytes Small %	Lymphocytes Large %	Eosinophiles %	Basophiles %	Mononuclears %	Color Index
1317	1065	163	12	B	85	5,500,000	7,000	55	30	10	1		4	7
				A	85	6,700,000	8,400	50	37	7		2	4	6
				A	80	7,950,000	18,000	38	49	9		1	3	5
				A	85	6,050,000	7,000	44	43	8		2		7
1119	1057	100	8	B	85	6,900,000	12,200	39	48	9		3	5	6
				A	85	5,800,000	12,800	32	52	8		4		7
1353	1097	211	19	B				60	23	11		2	4	
				A	80	5,150,000	22,200	57	27	8	1	2	5	.7
				A	80	4,600,000	8,600	39	51	8		1	1	8
1363	1123	114	10	B	85	5,200,000	12,600	42	43	8		1	6	8
				A	80	5,600,000	6,800	40	37	19		1	3	7
				A	80	4,300,000	7,200	26	58	14			2	9
1363	1125	263	17	B	85	5,800,000	10,200	63	22	10		1	4	7
				A	80	6,400,000	5,800	59	27	9		2	3	.6
				A	80	7,200,000	5,800	43	43	9			5	.5
404	1126	519	30	B	85	7,400,000	15,600	60	29	8		2	1	.6
				A	80	7,300,000	9,200	36	51	9			4	.5
				A	80	6,900,000	5,600	38	51	9		1	1	.6
				A	85	6,800,000	14,300	34	52	14				.6
1353	1128	440	28	B	85	7,350,000	10,200	44	42	12		1	2	.6
				A	85	7,100,000	9,600	46	34	10		6	4	.6
				A	85	6,250,000	15,600	31	49	14		1	5	.7
1346	1130	440	37	B	85	4,350,000	12,900	60	31	5		2	2	.9
				A	80	5,050,000	7,800	29	58	11			2	.7
				A	80	5,250,000	14,800	39	53	8				.7
1363	1131	354	36	B	85	6,450,000	8,000	45	44	9			2	.6
				A	80	6,000,000	6,800	43	47	10				.6
				A	80	6,800,000	5,500	26	61	13				.6

B. Before implantation
A. After implantation
Average percentage decrease of polymorphonuclears 33
Average percentage increase of small lymphocytes 58

cent in the average of the nine rabbits shown in that figure.

When we take a single animal and note the change in the readings from day to day, it will be observed (Table 15) that the first effect of the inoculation was an increase of the polymorphonuclears from 57 to 70 per cent, then finally a decrease to 31 per cent in six days, during which time the small lymphocytes increased from 34 to 62 per cent.

This is in part what happens in very many patients carrying dental infections to disfunction of certain glands of internal secretion.

By referring again to Table 15, it will be noted that the depression of the polymorphonuclears is associated with a change in the active or ionic calcium, which at first increased from 11.5 to 11.8, and then progressively decreased to 8.05. In more than 200 rabbits so tested, approximately 175 have died within a short time. Those that lived did not present this typical picture, nor did they show, as this group did, the development of fluid about the infected

TABLE 15.—COMPARISON OF CHANGES IN IONIC CALCIUM AND BLOOD MORPHOLOGY DUE TO CULTURE INOCULATIONS.*

Date 1923	Hemoglobin	Erythrocytes	Leucocytes	Polymorphonuclears	Lymphocytes		Basophiles	Arneth Index	Ca and Thrombin	Calcium Ionic	Ca Ionic and Combined	Calcium in Combination
					Large	Small						
6-1*	85	6,900,000	15,000	57	7	34	2	83	15.20	11.53	13.00	1.47
6-2	85	6,150,000	27,700	70.1	14.4	15.4		48	17.20	11.80	13.22	1.42
6-4	80	5,750,000	19,800	35.5	8.8	53.3	2.4		15.00	9.45	13.66	4.21
6-5	80	5,800,000	16,600	64.7	16.8	17.9			17.00	8.46	8.71	0.25
6-6	85	5,100,000	14,800	31.2	6.4	62.4			17.40	8.05	9.80	1.75

*Before inoculation.

which they and their dentists think are doing them no harm. Such a group of individuals will be shown in Table 16, in which will be seen a number of patients in whom the polymorphonuclears were depressed much below normal and the small lymphocytes correspondingly increased. There probably is no simple test available in the ordinary pathologic laboratory which will have so great significance and ease of determination in cases of suspected injury to the defenses of the body, without as yet signs of physical break in localized tissues, as has this comparison of the percentage of polymorphonuclears and small lymphocytes.

If time permitted, however, I would wish to refer to some other but unusual contributing factors which may contribute to this expression, relating chiefly tooth. On the contrary, those that lived invariably built a fibrous, highly vascularized capsule about the tooth, which adequately encapsulated it and which became in effect a quarantine station.

The activity of the leukocytes of the body, which are not only the chief phagocyting cells, but, which is much more important, furnish the bactericidins for the defense of the body, has been demonstrated by Hamburger and others to be chiefly dependent on the level of the calcium. In animals with a low calcium, it can be easily demonstrated that there is a depression of this factor by the simple procedure of placing the open end of a minute capillary tube of infected culture medium beneath the skin. The leukocytes will progress into the lumen approximately

TABLE 16.—BLOOD MORPHOLOGY OF CLINICAL CASES SHOWING TYPICAL LOW POLYMORPHONUCLEARS AND HIGH LYMPHOCYTES.

CHART	HEMOGLOBIN Per cent	CELL VOLUME Per cent	ERYTHROCYTES	LEUKOCYTES	COLOR INDEX	WALKER'S INDEX	ARNETH INDEX	POLYMORPHONUCLEARS Per cent	SMALL LYMPHOCYTES Per cent	LARGE LYMPHOCYTES Per cent	MONONUCLEARS Per cent	BASOPHILS Per cent	EOSINOPHILS Per cent
1237	98	44.5	5,680,000	6,200	0.96	-0.2	75	45.1	42.2	5.8	3.3	0.5	1.1
1233	100	33.4	4,860,000	7,000	1.04	-0.9	68	42.2	40.0	9.2	4.5	1.3	2.8
1213	98	43.0	5,672,000	5,400	0.95	-2.0	57	52.2	42.1	2.1	1.4	2.2	---
1198	97	53.0	5,080,000	5,400	0.97	-1.0	63	45.4	45.2	4.4	0.7	0.7	3.6
1197	100	51.0	5,830,000	4,800	0.86	-2.4	61	50.7	32.2	4.3	1.4	0.7	10.7
1189	98	49.2	5,190,000	6,200	0.90	-0.4	58	46.5	47.0	2.4	2.9	0.6	0.6
1187	97	44.5	3,620,000	4,270	1.32	-2.8	53	50.0	42.0	3.5	1.1	0.5	2.5
1186	94	49.5	6,060,000	7,400	0.78	-0.1	58	52.9	39.8	4.0	1.8	0.5	1.0
1183	105	50.5	4,840,000	4,600	1.10	-1.8	72	44.8	44.8	5.4	2.5	0.4	2.2
1182	97	42.0	4,780,000	5,300	----	-1.8	68	51.2	41.4	4.1	1.2	1.2	1.2
1179	98	43.5	5,560,000	5,400	0.87	-1.7	63	50.0	40.0	6.5	2.0	0.0	1.5
1175	92	46.0	5,060,000	8,600	0.89	-1.3	70	51.0	35.1	6.4	3.7	0.6	3.2
1173	98	50.4	6,100,000	8,000	0.81	-1.4	68	53.0	41.0	1.2	1.2	0.6	3.0
1171	100	49.0	5,060,000	8,400	1.00	-1.2	70	50.0	38.0	1.6	1.6	1.1	2.7
1168	98	39.5	6,200,000	10,000	0.80	-3.1	61	48.3	45.4	2.8	1.7	0.6	1.2
1164	90	50.5	4,840,000	4,400	0.94	-2.6	67	48.6	33.3	9.8	3.8	0.0	4.5
1163	95	46.0	5,575,000	5,400	0.86	-1.1	69	45.5	38.5	4.0	4.5	6.0	1.0
1149	96	---	6,600,000	19,200	0.87	----	--	40.2	14.5	6.0	- -	0.0	38.5
1146	98	---	5,450,000	4,200	0.91	-3.4	71	53.2	33.4	5.7	2.8	1.4	3.5
1143	85	---	4,930,000	5,000	0.86	-3.7	64	52.6	35.5	5.9	1.8	0.6	3.6
1133	80	---	4,520,000	9,000	0.89	-1.9	67	50.0	41.4	2.6	1.6	1.1	3.3
1131	85	---	5,100,000	7,300	0.84	-0.0	66	48.0	39.3	5.4	3.8	0.0	0.5
1130	90	---	5,675,000	7,000	0.85	-0.2	55	50.0	39.0	4.0	5.0	2.9	1.1
1123	85	---	5,650,000	7,600	0.80	-0.5	71	53.0	37.5	5.0	2.5	3.5	0.5
1121	80	---	5,920,000	5,200	0.76	-2.3	57	51.0	41.8	1.2	1.6	1.2	1.2
1114	85	---	5,344,000	5,400	0.83	-1.9	58	52.5	35.6	6.0	5.5	2.0	0.5
1112	85	---	5,640,000	7,800	0.80	-0.3	60	50.0	37.0	4.2	4.2	1.6	0.5
1110	85	---	4,680,000	6,400	0.85	-0.7	44	52.1	40.0	4.0	2.5	0.5	3.0

a half inch in two hours, if the rabbit has a normal calcium level, but will not travel more than half that distance if there is an active calcium level that is depressed from 10 to 20 per cent below its normal.

If calcium lactate is introduced into the rectum of such a rabbit, it will, in less than an hour, show an increase in the rate of migration of the leukocytes, as they are induced by chemotaxis to progress into the tube to the organisms.

Negative by JOHN P. BUCKLEY, Ph.G., D.D.S., F.A.C.D., Hollywood, California

Mr. Chairman, Dr. Price, Ladies and Gentlemen:

A little more than seven years ago, I left my many near and dear friends in Chicago to live elsewhere, and as I went I promised those who seemed interested that I would forget the pulpless tooth and other dental problems and devote my efforts for a time to more personal matters. This I have been doing. But, my friends, it is like giving up life itself to give up the work you love; therefore, I voluntarily return to the arena tonight to debate with a trained and learned opponent what I consider to be one of the most momentous problems before the dental profession today. Compared to the question as to what it is best to do with the infected pulpless tooth, all other questions sink into insignificance. Practitioners everywhere, in both medicine and dentistry, want to do the right thing for the health and comfort of the patient, but what is right under the circumstances, they are left to decide for themselves amid a bewildering and confusing mass of misconceptions.

It was because I felt that Dr. Price was responsible in large measure for the uncertain state in which dentistry finds itself today in relation to this subject that the challenge was made to debate the question; coupled with the further fact that committee work in the House of Delegates last year at Dallas prevented my taking part, as was scheduled, in the discussion of the paper presented by him. I may say here that the challenge was accepted without hesitation. Only slight changes were suggested in the wording of the question as submitted, and these were willingly granted.

I commend Dr. Price for the able manner in which he has presented the affirmative side of the argument. While I do not agree with him at all, he has certainly been fair. In speaking for the negative, I trust I shall be equally fair. If it becomes necessary for me to speak plainly and to the point in presenting my side of the question, I want the audience to know in advance that there is nothing personal intended. For nearly twenty-five years, Dr. Price and I have been friends. This friendship will continue after this debate. This is not the first time that I have accused him of being on the wrong side of the question, and he has always been equally frank with me.

While I hold my opponent personally responsible for much of the criminal practice that is being done today, because of his published writings and his position as head of the Research Institute of the American Dental Association, and thus considered an authority, I should like to give him credit for being honest and sincere in his convictions and do credit him with stimulating the spirit of research in dentistry more than

any other man in the profession. This in itself is sufficient justification, if justification were necessary, for all the time and money spent by the profession in furthering the work of the former Research Institute.

That great statesman, Thomas Jefferson, once said, "Truth is great and will prevail if left to herself; she is the proper and sufficient antagonist to error and has nothing to fear from the conflict unless disarmed by human interposition of her natural weapons—free argument and debate." Jefferson also said, "Errors cease to be dangerous when it is permitted freely to contradict them." My friends, I am here tonight only in the interest of truth. Truth always profits by controversial discussion. We should approach the subject with an open mind and be ready at all times to change our ideas and position when the facts are against them; but we must be certain of the facts. I know what it means to study, and delve, and seek and experiment in an endeavor to discover new facts or make a new application to an old discovery, and I would be the last man to attempt to stem the tide of progress and discourage those who are conscientiously searching for the truth.

As a premise to my discussion, let me state again that I am firmly of the belief that Dr. Price is wrong in his interpretations and teachings and I take the position that practically all recently infected pulpless teeth, with or without bone involvement, can be treated and saved without jeopardizing the health of the average patient in any way. While I cannot discuss treatment in detail at this time, I will say in passing that I also firmly believe that simple remedies and a simple technic for the treatment of such cases is as effective as more complicated measures. The point I desire to emphasize in this connection is simplicity of treatment. Complicated methods are expensive, in many instances prohibitive, to the patient, and always unnecessary. If the tooth can be saved at all, it can be saved by simple means of treatment. I hold that the claim that the periapical area must be absolutely germ free before it is safe to fill the root and that the operation of treatment can only be done successfully under strictly aseptic conditions has confused the issue and discouraged the profession, and is not based upon facts. Later on, I expect to show that the normal tissues of the body are not always germ free. Why should we demand more here than Nature requires with other tissues? Reasonable measures of asepsis, working with and through antiseptics and disinfectants, which is easily accomplished, are all that is required for success, provided the apices of the root are closed by a properly selected root-filling material.

These statements I hope to substantiate in this debate. If it is thought necessary for further proof after my original argument, I now reserve the privilege of illustrating my point by showing with the lantern in the time allotted for rebuttal, a series of cases so treated. In this relation, Berger[1] of New York says:

> If curing a disease can be summed up into removing the cause, eliminating the symptoms and signs of the disease, establishing repair of the injured parts, and in so far as this is possible excluding the possibility of the recurrence of the disease, then the contention may well be regarded as sound medical judgment that in selected individuals and in favorable cases, pulpless teeth even when

1. Berger: Dent. Items Int., 44: 341 (May) 1922.

diseased can be rendered innocuous and may be retained as beneficial members by the individual. We may also justly reason that in the presence of such vital processes as must manifestly go on where extensive tissue repair and regeneration is taking place, the serum of the blood and the phagocytic agencies specially evolved by Nature which are inimical to the well being of the life of the organisms are well adapted to combat and eliminate these minute organisms and their toxins, if still present.

In his presentation tonight as in all of his published writings, Dr. Price has emphasized the inadequacy of the roentgenogram alone as a certain and positive means of arriving at a correct diagnosis. I did not know that the profession depended on the roentgen ray to the extent my opponent and others would lead us to believe. All that has been said about the limitations of the roentgenogram may be repeated with equal emphasis regarding bacteriologic findings, on which so much dependence is placed. All such means are but factors used by the trained diagnostician, always in conjunction with the clinical manifestations, in drawing his logical and well-founded conclusions. It has been said that we cannot "see pathology" in a roentgenogram. This is correct. Evidence only of pathologic lesions may be thus detected, and it is only corroborative evidence at that. However, on this point, Pollia[2] says, "I am not yet willing to admit that with proper technic of ray projection and correct development of the film, plus the average knowledge of *accepted* pathologic facts in regard to the reaction in bone tissue, the roentgenogram is not the best indicator that we have of the conditions therein." I would not discount bacteriologic evidence, but I do say that clinical and roentgenographic evidence is far more reliable. All such evidence should be taken into consideration. Dr. Price and his followers place as much dependence on purely bacteriologic findings in the laboratory as he has justly criticized others for doing with the roentgenogram. Each by itself may be equally unreliable. Do not misunderstand me here. I yield to no one in my appreciation of a conscientious effort in matters of diagnosis. My regard for the true diagnostician and conscientious surgeon almost approaches reverence. Nine years at the wrong end of the instrument qualifies one to speak with some degree of feeling on matters of this kind. I know from personal experience the meaning of mistaken diagnoses and of the intricate problems involved.

Personally, I would not take this debate so seriously were it not for the far-reaching effects that publications of the kind from the pen of Dr. Price and others have on the professions of both medicine and dentistry. When read, they are considered by many as authoritative, accepted without question and quoted freely in justification of the radical stand many men are taking today with reference to the ruthless extraction or so-called surgical removal of pulpless teeth. If Dr. Price is willing to assume the responsibility for the radical extraction of all pulpless teeth, I ask him, as I have asked others, to come out in the open and say so in so many words, or if he does not wish to so assume, then, for the benefit of his profession and to guide those who always follow blindly (I use the word advisedly), it is his plain duty in presenting his findings to advise caution

2. Pollia, J. A.: Dent. Items Int. 44: 351 (May) 1922.

until we are more certain of our ground than we are at the present time. But instead of this, Dr. Price leaves us absolutely hopeless. In vain have I searched his writings for a single word of encouragement for the treatment and root filling of a pulpless tooth. I have never heard him say in so many words that all pulpless teeth should be removed nor have I heard him advocate the radical curettement of the area involved, but for several years now he has been painting the picture of their retention so terrible that those of us who still dare advocate the treatment of such teeth, under what we believe to be favorable conditions, wonder if we are criminals at heart; while those who are seeking encouragement from whatever source for their radical stand on the removal of all pulpless teeth and justification for extensive surgery in their removal, look on Dr. Price as the Moses who is leading dentistry out of the wilderness.

No one should be held responsible for wrong conclusions drawn from their writings, but when we are looked on as an authority, and especially when dealing with a matter as vital as this, including as it does the health and even the very life of humanity, we should be extremely careful in making our positions clear. This, I claim, my opponent has failed to do, if he did not intend to imply that pulpless teeth, under any and all conditions, are dangerous to leave in any mouth. Too many educators and leaders today in all walks of life are far more concerned about saying what they think than they are about thinking what they say.

Let us refer for a moment to some of Dr. Price's[3] publications. In his paper read at Dallas, we read the following, "We have thought of the type or strain of organism as being the chief and determining factor in infection. We now have evidence that the soil is the most important factor. In other words, our chief attention is being changed from the biologic qualities of the organism to the biologic qualities of the host." First, with Dr. Price, at the Congress at San Francisco ten years ago, it was his newly discovered bacteria X, of which we have heard nothing since; then, it was the streptococci; yesterday, it was the particular type or strain; today, it is the soil or the biologic qualities of the host; tomorrow, it may be something else. The trouble with my opponent, as I see it, is that he travels too rapidly or he does not stay in one place long enough for those of us who are a little sluggish to get our perspective or bearings. But it must be admitted that he is making progress. Conflict between the new and the old always results in progress. Certainly it is time we were giving some consideration to the host. The latter here is neither a rabbit, a rat nor a guinea-pig. The resistance to infection in a child is much less than in the adult or those in middle life. If this is true, which cannot be denied, then what can be said of the resistance of a young rabbit or guinea-pig compared to that of a man? In his experiments, with animal inoculation, Rosenow is reported to have used up to 75 c.c. in a single dose, while Haden[4] uses only 5 c.c.

3. Price, W. A.: Fundamentals Suggested by Recent Researches for Diagnosis, Prognosis and Treatment of Dental Focal Infections, J.A.D.A., 12: 641 (June) 1925.

4. Haden, R. L.: Am. J. M. Sci., 169: 407 (March) 1925.

The latter says, "This is a big dose—much more than a patient ever gets at one time." Is it any wonder that the innocent young rabbit is overwhelmed? In answer to a question here, Haden said, "The diagnostician should be very cautious in assuming that the patient has or will have lesions similar to those found in the inoculated animal." I have never heard of a precaution like this from Dr. Price.

In view of our present understanding, perhaps I had better say misunderstanding, I do not accept the bacteriologic findings of Price, Rosenow and others as final. Rosenow, I recognize as a bacteriologist of note, but if he has done any special work along the line of dentohistopathology to qualify as a dental authority, I do not know where it is recorded. Against the findings and interpretations of these men, we have the investigations of Gilmer and Moody, Hartzell and Henrici along bacteriologic lines, and the histopathologic work of Black, Noyes, Thomas, Endelman, Grove, Grieves, Crane and, latest of all, Hatton, to guide and encourage us in our root-canal therapy. I know of no dental college, any place, anywhere, which does not include a course in root-canal therapy and surgery in the curriculum. In these colleges, we find men who are spending all of their time teaching and experimenting, endeavoring to find the truth. There is scarcely a college in the country but has at least one man on its faculty who is just as well qualified from his knowledge, training and experience to speak as an authority along these lines as is my worthy opponent. Let us keep our feet on the ground and not deceive ourselves.

This statement is made in all sincerity after reading the concluding chapter in Dr. Price's[5] book, where he makes a plea for special research institutes for dental diseases. Here he says:

> In addition to developing the new truths which underlie both correct living and adequately improved medical and dental methods of practice, there must be developed a new type of practitioner. He will be neither a physician nor dentist, nor both, in the sense that he will be a combination of the two as they exist today. The science and art involved in the interpretation of the profoundly obscure and involved relationships, which may exist between the local and the systemic expressions of dental disease, can only be provided by men who have had a special training, quite unlike that that can be furnished by any dental or medical school today. These researches, which I have recorded in this book, illustrate splendidly how neither the medical nor the dental profession has been able with its training and equipment of the past to diagnose, prognose, and treat these most intricately involved pathologic relationships; and while we can see the necessity for this new type of practitioner, we could not develop him today in any institution, available for teaching that now exists. There must be developed both a new foundation of combined special medical and dental science and new methods of application.

My friends, if this is not admitting in cold black type that Dr. Price himself is the only man, in either the medical or dental profession who is qualified by training and experience to speak with authority on this subject, then I do not understand the English language. This is the thing to which I seriously object. There is a possibility that even Dr. Price is not familiar with all of Nature's laws. I grant that he is a student and a worker. I am willing to grant also that he is honest and sincere, though, at times, it is difficult to understand; but I say without hesitation that his utterances and published writings

5. Price, W. A.: Dental Infections and Degenerative Diseases, p. 406.

have absolutely disqualified him as a safe leader in any field that he has attempted to survey, including electricity, metallurgy, bacteriology, pathology, pharmacology, physics and chemistry. Modesty is a thing to be admired, but modesty, after all, is but the art of concealing one's pride. Dr. Price exhibits a justifiable pride in his work, and I ask him, therefore, in closing, to forget his pride for the moment and name a single, outstanding, worthwhile contribution that has stood the test of time which he feels he has made in any of these several named sciences for the advancement of dentistry. Then I will answer him if I can or acknowledge my mistake. I want to be fair to my opponent; I must be fair to my profession. I have given him full credit for stimulating the spirit of research in others. The point I wish to make here is that Dr. Price, today, has not proved himself a safe leader in any field.

Let me make myself clear: I repeat that, for years, Dr. Price has been playing on the sympathies of his audience by painting the picture of the retention of pulpless teeth so pathetic that only one logical conclusion could be drawn; but, to my knowledge, he has never had the courage to come out openly and draw the conclusion himself. With that winning smile and pathos in his voice, he turns to his audience and says, in substance, "Now this is what I have found. I leave it to you, having confidence in your judgment and common sense, to decide what should be done." My friends, it is hard to believe that a man is sincere when he continues to adopt these methods, with the havoc that has followed in his trail. But here I adopt the tactics of my wily opponent and will let you decide this point. I, too, have confidence in your judgment and common sense. I give you the evidence and the facts.

Referring again to the paper previously mentioned:[3] If I were looking for a series of cases to show on the screen that would enlist your sympathies and touch your heart strings, I could go to the Children's Ward of the General Hospital or to the Orthopedic Hospital for Children in the city of Los Angeles and get pictures of dozens of cases in which the hands are tied into knots, bodies all twisted out of shape, and mouths reeking with decayed and infected teeth. But I know of few cases, if any, in which it could be claimed or even suspected that the teeth were the primary cause of the deformity. The teeth in these cases are secondarily involved because the poor little sufferers are not able, physically or financially, to give them the proper care. In both of the above named institutions, there is a well equipped dental department, and physicians and dentists cooperate in the treatment of the hundreds of cases handled yearly.

The judicious extraction of infected teeth in cases like these should naturally be expected to afford some relief as it helps to relieve the overload; but, to infer or leave the impression that such cases can be practically cured by simply removing the infected teeth is, I claim, going too far. Such an impression was left by Dr. Price in the article read at Dallas when he cited the case of a 16 year old, bed-ridden boy (page 654). Here, he implied that the seemingly miraculous improvement was due wholly to the removal of certain infected teeth, though he does admit that "it was apparently assisted by the use of a vaccine." Let us stop and think for a moment about the case as reported.

The boy was 16 years old at the time of the report. It had been six years since the "apparently roentgen ray negative but definitely infected teeth" were removed, following which there was such a "remarkable and rapid improvement." The mother said the suffering and deformity had been going on since the boy was 12 years old. He had been helpless for years. In a few months after the removal of the infected teeth, "many joints, stiffened for years, had limbered up. Relief from pain was complete." This is truly a remarkable case, and if Dr. Price is correct in his diagnosis and report, it is one case in hundreds where deforming arthritis is primarily caused by infection from pulpless teeth in a child 10 or 12 years of age. For teeth to have decayed with pulp involvement, death of the organ and subsequent systemic involvement, would mean that the pulps died, in all probability, before the roots were completely calcified. Few men would attempt to save such teeth today whether the patient was systemically involved or not, and none, I trust, would make such an attempt when the patient was systemically involved. Dr. Price knows this. But does he emphasize or even intimate that the case is exceptional? No. On the contrary, he says, "The boy is just one of the many that have had the misfortune to be born from a parentage that did not have a normal and adequate defense against streptococcal infection and did have a very severe susceptibility to dental caries, which is characteristic of the individuals of this group." By reading this article, one would be led to believe that this is just an incidental case in practice, one of many that could be reported. My years of experience and observation tell me that this is not true. The case as reported is a rare exception indeed. It would appear at times that my opponent deliberately and intentionally tries to mislead, but I hardly believe this. I would rather think that he has convinced himself that he is right and is rendering a great service to humanity. I hold that, to date, the publication of his investigations has done far more harm than good, and that to follow him is not only unsafe: it is positively criminal in its tendency.

Now, to return to the subject: I am making no plea, nor do I know of anyone today who is pleading for the retention of infected pulpless teeth or pyorrhetic teeth when the infection cannot be eliminated by treatment or when there is systemic involvement, indicating an overload. We should study carefully the subject of natural and acquired immunity and understand more fully the biochemic properties of the tissues and fluids of the body; the production of antibodies, Nature's method of controlling and eradicating disease. We should not decide what should be done with infected pulpless teeth until after we have questioned and studied the individual patient. The condition of the patient should be the deciding factor. If normal resistance is lacking, as evidenced by grave constitutional disorders, it would certainly be a mistake to advise the patient to continue with the overload when it could be reduced or, perhaps, entirely corrected by the judicious extraction of certain infected teeth. But when normal resistance is evidenced, by the absence of systemic involvement, as far as is known or can quite readily be determined without unduly frightening the patient, we have an entirely different story. This is what I had in mind when I took the position that practi-

cally all recently infected pulpless teeth, with or without bone involvement, can be treated and saved without jeopardizing the health of the average patient in any way. The great majority of patients with evident foci of infection in the mouth are not systemically involved. This is what I mean by the average patient.

In those cases in which extraction is plainly indicated, there can be no valid objection to the judicious use of the curet for the purpose of removing, if present, infected masses of periapical granulation tissue, and thus surgically aiding Nature in her efforts at restoration. Such infected masses, however, are not always present, and to the needless removal of healthy bone in effecting the curettage and mutilation of the mouth as has been done in many cases, there is every objection. The principles underlying all surgery teach the conservation of healthy tissues whenever and wherever possible. Dr. Hugh W. MacMillan,[6] of Cincinnati, gives us a scholarly and scientific reason why this is especially true of bone surgery of the mouth. Much of the recent dental surgery has destroyed healthy bone with reckless abandon. Some writers would lead us to conclude that so-called "residual areas of infection" result from the extraction of all pulpless teeth when curettage does not follow or accompany the operation. Those of us who have been in practice for a period of years and who have observed this phase of the question know that residual areas of infection in such cases are the exception and not the rule. The simple extraction of the offending tooth in most instances eliminates the infection. In support of this, if need be, I point to the writings of Brophy, Gilmer, Logan and others.

"A little knowledge is a dangerous thing;" likewise "a lighted torch in the hands of the blind" is hazardous. I regret to say, but duty demands that which my audience knows to be a fact, that the average dentist knows just about enough of pathology and bacteriology to ask one or two seemingly fairly intelligent questions. Then he is through. Few students care for these subjects in college, and fewer still continue their study after graduation. This would not be so tragic if they would admit their lack of knowledge, which is no reflection, and depend for guidance on others who are recognized as students of the subjects. It is not expected that a practicing dentist or a general practitioner of medicine be experts in pathology and bacteriology. But many men of this character today, encouraged, as I have said, by Dr. Price and others, are advising the extraction of all pulpless teeth, basing their procedure on an assumed knowledge of these underlying sciences. A careful survey of the situation reveals the startling fact that these men, for the most part, are masquerading as specialists in dentistry, viz., in roentgenography, oral surgery, partial denture construction or some similar line.

I do not object to anyone admitting that he, personally, cannot successfully treat pulpless teeth and place them in such condition that they will not be a menace to the health of the patient; but when he goes so far as to infer or to state boldly that it cannot be done by others, I am here to say that he either does not know what he is talking about or he is deliberately concealing the truth. As others have

6. MacMillan: Bull. Chicago Dent. Soc., 5: 10 (April 10) 1925.

said, if surgical interference were necessary in all bodily infections, most of us would be dismembered inch by inch. No medical man would admit for a moment that infections elsewhere in the body cannot be eradicated by treatment, and for us to admit that dental infections cannot be removed by therapeutic measures is but to admit failure. Having spent all of my professional life working along this line, I am not yet convinced that these twenty-seven years have been spent in vain. No, my friends, the argument is as thin and transparent as glass. It offers no ocular obstruction whatever to those who think, for it is based on neither good judgment nor common sense.

I do not doubt that the bacteriologic findings of men like Price, Rosenow, Haden and others are correct so far as we understand bacteriology today; but you know and I know that there is something wrong with their conclusions based purely upon these findings when they say, by inference at least, that no pulpless tooth is safe in any mouth. In justice to Haden, I must say that he is far more rational in his deductions than the other two named. I am certain from his writings that if Haden had a better grasp of dentohistopathology, which lack of knowledge he frankly admits, and knew more about what could be done by modern root-canal therapy, he would be a safe man to follow. It must be admitted that, at best, our knowledge of pathology and bacteriology is far from being definite; so many problems are still baffling; so much we do not know. Science is still ignorant of so many of Nature's laws. Too many people accept statements without thinking. This is as true of science as it is of politics and religion.

For several years, now, Dr. Price has been continually magnifying the pathologic significance of the presence of bacteria in bodily tissues. Let us review the literature on this subject and learn a few important facts. By surveying the entire field, we find that, throughout Nature, bacteria are abundant in the environment of man and animals. Parasitic bacteria live habitually on the surface of the body or on mucous membranes without producing noticeable effects. The outer integuments of the skin and hair, the mucous membrane of the conjunctivae, the intestinal and respiratory tracts are constantly inhabited by bacteria. The distribution of certain species in definite localities is often sufficiently constant to be regarded as a normal condition. Certain cocci and spirillae are always present in the mouth and pharynx.

The metabolism of the parasitic organisms approaches rather closely the intracellular metabolism of the host; that is to say, they thrive without producing deep-seated and rapid degradation of proteins. Elaborate investigations of the bacterial flora of the skin have been made. Seventy-eight different species have been found under the finger nails; twenty-nine on the skin of the foot; eighty on the hands. Many of these, of course, are only accidentally present. The skin may be temporarily contaminated with bacteria from other portions of the body or other persons' bodies, from the intestines or from the lungs (tubercle bacilli), etc. The staphylococci are permanent parasites of the skin. They are found even in the deepest epidermal layers. If the skin is peculiar in its moisture or secretions, other forms of cocci may be found.

Large numbers of bacteria, indeed

practically all known bacteria, may at one time or another gain access to the mouth through the inhalation of air containing dust; from the tear ducts, and in other ways. The mouth is the most important portal of entry for the great majority of bacteria, both pathogenic and nonpathogenic. The normal flora of the mouth is quite varied, including not only the bacteria which are ordinarily regarded as harmless but also organisms which may occasionally or frequently incite disease.

The influenza bacillus, diphtheria bacillus, pneumococcus and even the tubercle bacillus may occasionally form in the nose and throat, of healthy individuals. The occurrence of these organisms is readily explained. The secretions of the nose and throat, as well as those of the skin, are excellent culture mediums for these organisms which collect at the sites and grow upon the various secretions and desquamated cells. Even the internal organs of healthy individuals may contain parasitic bacteria without harm, although naturally these organisms are not present in large numbers. Tubercle bacilli have been found occasionally in lymph glands in normal man and in cattle. Intestinal bacteria also occur not infrequently in the apparently healthy tissues of the body. In rare instances, the colon bacillus may be present in the urinary bladder without causing any noteworthy symptoms. Theoretically, people who harbor staphylococci, streptococci, pneumococci and diphtheria bacilli may be a source of danger to other people, though they themselves be immune. To the individual who carries these organisms, they are nonpathogenic, since their initial invasion caused the disease and produced an immunity.

The crypts of the tonsils afford mechanical protection to bacteria which gain access to them. The secretions and tissues undoubtedly provide the necessary nutritive elements so it is not surprising to find many types of bacteria in the tonsils. Staphylococci and streptococci, both hemolytic and nonhemolytic, are almost invariably present. The tonsils, which are in direct communication with the lymphatic system, are important avenues of invasion, particularly for streptococci. The tonsils appear to bear the brunt in certain diseases, and they are probably of importance in shielding the body from invasion through the lymphatic system by directly holding back the bacteria. The lymphatics of the jaw drain into the tonsils; hence, infection through bad teeth should be borne in mind.

Parasitic bacteria may under certain conditions invade the body of the host and become temporarily pathogenic. Such an invasion is usually subsequent to a preexisting disease or to a local weakening of the tissues, which, under normal conditions, suffice to exclude these organisms. Such infections do not represent, perhaps, so much an assumption of pathogenic power on the part of the microparasites as they do a disturbance of the defensive mechanism of the host, whereby the normal relations are disturbed and microparasites that ordinarily are harmless become disease producers.

Now to epitomize: The significance of the presence of bacteria in any tissue of the body must be dependent on whether or not a diseased condition or infection exists. What then is infection? According to McFarland,[7] "In-

7. McFarland, Joseph: A Textbook Upon the Pathogenic Bacteria and Protozoa, Ed. 9, Revised, 1921.

fection is the successful invasion of a tissue by microparasites, with cellular change and inflammatory reaction." In other words, infection means an abnormal condition resulting from the deleterious action of the parasite upon the host. Strictly speaking, then, a pulpless tooth cannot be infected. It may harbor, or be *infested* with, bacteria, but not infected. The germs can neither successfully invade the tissue (tooth structure) as such, nor can they cause cellular change or inflammatory reaction. Pulpless teeth with open formina infested with or harboring bacteria can, and frequently do, cause infection of the periapical tissue. Let us get clearly in our minds that the presence of germs and infection are not synonymous. Organisms may, of course, find entrance to any tissue or organ in the body, but unless they grow, multiply and produce some deleterious action on the host, their presence is without any special significance. Dr. Price must know this, but has he ever made it clear? Again I repeat that he has been continually magnifying the significance of the presence of bacteria in the tissues of the body. Whether he has done this intentionally or otherwise, I do not know. But you know and I know that, for several years now, he has given us absolutely no hope for saving a pulpless tooth, with the result that many mouths have been needlessly wrecked.

Dr. Price himself recognizes that thousands of sound teeth have been needlessly sacrificed in this wave of extraction, in the vain hope of giving relief to suffering humanity. In his book[8] "Dental Infections Oral and Systemic," after citing a case in which relief seemed to follow the extraction of six suspected teeth, he says

> Just here I wish to introduce a warning: Exodontists and physicians who do not have the heart rendering worries of making dentures comfortable and serviceable under conditions which are so nearly impossible as to be very discouraging, but where the very nutrition of the patient demands a persistent effort, will be disposed to take the evidence just cited as justifying the extraction of all the teeth in this and similar patients. I wish to stress that we have come to the time when involved teeth can be so definitely differentiated from those that are not involved or with sufficient limit of error, that we are not justified in condemning all of the teeth for fear they may be involved. I am seeing continually patients who are suffering more from the inconvenience and difficulties of mastication and nourishment than they did from the lesions from which their physician or dentist had sought to give them relief.

This is a frank admission on the part of the author, and yet, when Dr. Price gave the warning, he had in mind only the ruthless extraction of teeth with vital pulps. As I have said before, he gives us absolutely no hope whatever for saving a pulpless tooth under any condition. My God, men! Whither are we drifting? There is such a thing as carrying science, so-called, far beyond the realm of the ridiculous and plainly to within the limits of criminality.

Were the results not so tragic, it would be positively amusing to note the extent to which men will sometimes go to justify their preconceived ideas. Dr. Carl D. Lucas,[9] in a paper read in June, 1925, before the Southern California Dental Association, speaks of the bone which regenerates around the ends of treated pulpless teeth as pathologic bone, produced, as this author says, by "pathologic osteogenesis." Surely this is

8. Price, W. A.: Dental Infections, Oral and Systemic, p. 488.

9. Lucas, C. D.: Pacific Dent. Gaz., to be published.

treading on dangerous ground. To quote from the paper, "Regeneration of bone in the presence of pathologic infection is an histopathologic phenomenon—due to the stimulation by toxins from the organisms of low virulence, not being sufficiently virulent to cause osteolytis, but on the contrary, cause low grade osseous structure." In the discussion of this paper, I frankly admitted that I did not know Nature worked this way.

In the hundreds of cases in which apicoectomy or root-end resection, had been performed a period of ten or twelve years before, I have had occasion in but few instances to reopen the area after bone regeneration, and I do not recall a single case in which I found the bone as described by Dr. Lucas; namely, with the cancellous spaces abnormally large, considering that it was new bone, nor did these "spaces contain a milky-like fluid which could not be considered frank pus," and have a "distinct characteristic odor." As I say, I have had occasion to examine only a very few such cases in which subsequently, for some prosthetic or other reason, it was thought best to remove the tooth. I have seen many cases, however, in which, after operation, the bone did not regenerate. This was in the early days when apicoectomy was done without re-treating, sterilizing and filling the canal. No one would think of operating today under these conditions.

When will we learn that the mere presence of bacteria in the tissues of the body does not, in itself, mean an infection? Nor does rarefaction of bone as shown by the roentgenogram always mean an infection. Haden[10] says, "Teeth may be negative in the roentgenogram and yet be infected, since there must be many bacteria present before sufficient bone destruction takes place to show in the roentgen ray. On the other hand, teeth around which there is evident bone destruction may have become sterile and thus be harmless from a systemic standpoint." In the same article, Haden reports a group of 134 patients in whom the roentgenogram did show evidence of "alveolar abscess," as shown, no doubt, by rarefaction, and he concludes, "Since we have proven by culture that many such abscesses are sterile, it does not necessarily follow that all individuals of this group really have periapical infection." To quote further, from another article by this author: "Cultures from several hundred pulpless teeth which showed no roentgenographic evidence of infection demonstrate that approximately 40 per cent harbor bacteria in sufficient number to be a possible focus of systemic disease."

Then we pick up another journal and read from Pollia,[2]

> The thought that some of these reported bone "infections" might be "presence" of bacteria, especially where satisfactory roentgenographic reproduction of the bone indicated no pathologic variations whatever, led me to make a series of experiments to see if it were possible to obtain cultures from normal bone tissue in the jaws. The lacunae which holds the bone cell has coming from it canaliculi. These canaliculi communciate with canaliculi of other lacunae, and in turn with the lymphatics of the pericementum. The lymphatics of the pericementum communicate with those of the mucosa.
>
> The function of the canaliculi is supposed to be for the passage of nutritious fluids.

10. Haden, R. L.: Differential Leukocyte Count in Chronic Periapical Dental Infection, J.A.D.A., 10: 596 (July) 1925.

Since these canaliculi are indirectly connected with the lymphatics of the mucosa, and since the lymphatics of the mucosa drain the bacteria and their products, it occurred to me that bacteria could pass through these channels and find their way into bone tissue through the medium of the canaliculi and their anastomoses.

Then after explaining the careful aseptic technic of his experiments, Pollia reports, "Out of thirty-nine pieces of spongy normal process removed under strictly aseptic technic, twelve gave positive cultures of streptococci."

Think of it! Dr. Price condemns practically all pulpless teeth, while others condemn them all, on the premise that an approximate 40 per cent of those showing no roentgenographic evidence of infection, are found to harbor bacteria, and the percentage does not vary greatly when the roentgenogram does disclose a suspected area; and this in face of the fact that many normal tissues of the body are known to harbor the same bacteria and that 31 per cent of specimens of healthy bone examined by Pollia were found to contain the streptococci. Quoting Haden again: "A fairly large percentage of teeth that are positive roentgenographically did not harbor any infection or sufficient infection (he means bacteria) to be a factor in systemic disease at the time the culture was made. In such cases the infection has probably run its course and become bacteria free, as happens in infection elsewhere in the body." I have never heard of Dr. Price recording any such findings. This brings me to ask two pertinent questions: First, does my opponent report his findings "as is," or does he report only such as would seem to justify his preconceived ideas? And secondly, does this not prove that as a scientific investigator he is either incompetent or unreliable or both? Certainly, it must be suspected that he lacks the tireless and irresistible courage of complete sincerity and sanity.

There was a time, not so many years ago, when it was claimed by some that regenerated bone in the periapical area of treated pulpless teeth would fluctuate. By this, they meant to say that bone would fill in the area destroyed by the infectious process, then would again be removed by some resorptive or other process. Since this has been proved not to be the case by frequent and subsequent roentgenographic evidence, other hypotheses, it would seem, must be advanced to justify the radical surgery of the recent past; therefore, this latest theory, and it is only such, that the new bone is pathologic, having been produced by "pathologic osteogenesis." Where, let me ask, do these men draw the line? On this line of reasoning, why is not all newly regenerated bone pathologic? that, for example, in the case of osteomyelitis of the tibia, or other bones of the body, treated by drainage? Even in operative cases, who can guarantee that some bacteria or infection does not remain after our most careful surgery? Granting this to be possible, which I do not grant for a moment, how can we prevent bacteria being brought to the part of the blood supply? Do we not know that regeneration of bone is dependent on the blood, with all of its hemal elements? And no one longer doubts, I believe, the presence, under certain conditions, of bacteria in the tissues and fluids of the body or their hematogenous or lymphogenous transportation from one part of the body to another. Finally, here, I ask, have we lost all

confidence in Mother Nature? God help us, were she not so kind!

Most of us, I think, could report cases in which the removal of questionable teeth seemed to improve markedly the systemic involvement; yet as many cases can be cited in which the same suspicious teeth were sacrificed with no improvement whatever, the patient being left with a crippled masticatory apparatus and further complication of the systemic trouble. Speaking of cancer and its prevention in a recent article, Sir William Arbuthnot Lane,[11] surgeon and dietitian, of London, recognized the world over as an authority on medical subjects, said

> In an endeavor to discover the cause and cure of cancer, the laboratory workers have had long innings and they have very little indeed to show for it. Meantime, the indications of what causes cancer may be found, by inference, among the uncivilized tribes of the earth. We have simply been studying germs when we should have been studying diet and drainage. What good would it do to discover the cancer germ? Have we not already discovered the germ of tuberculosis, without thereby removing the disease? We have minimized tuberculosis only to the extent that we have minimized the operation of its causes. We know now that sunshine, fresh air and good food are fatal to tuberculosis. Knowing these things, we need not worry about the germ that accompanies the disease.

When a man of the standing of Dr. Lane speaks, we should listen. What he has said about the unknown germ of cancer and the known germ of tuberculosis might apply with equal force to some of our other unsolved problems.

My friends, I am only nicely started, but I fear the tap of the presiding officer. I close by saying that, since returning from the Louisville meeting, I have learned that the State of Nebraska was recently circularized with a questionnaire on this problem. Out of the number of dentists who answered and returned the questions, 37 per cent do not approve of retaining a pulpless tooth in the mouth under any condition. Would you believe it? But the fact still more startling is this: 25 per cent of the number, not of the 37 per cent but of the entire number who replied, graduated from college since 1920. This is the sad thing, the pathetic thing, that hundreds of the younger men, not alone in Nebraska but everywhere today, are not bewildered. With them the problem is settled. They openly boast that they have treated their last pulpless tooth. But, thank God! most men in our profession have a conscience and do stand in bewilderment. They are absolutely lost and know not what to do. To these, let me say that no man who yields to the dictates of his conscience can go wrong, and he who applies the Golden Rule in his human affairs will find conscience an ever ready and ever willing aid. God giving me the strength, I will spend the remainder of my life, if need be, correcting this damnable and criminal practice for which you, sir, Dr. Price, whether you realize it or not, are in large measure responsible.

Dr. Price (in rebuttal): No one will have surmised, until he has been informed, the tremendous significance and importance of calcium in the various physiologic processes of the body, in plant life as well as in animal life. Even the rate of heart beat and the strength or volume is largely influenced and controlled by the

11. Lane, W. A.: Dearborn Independent, June 20, 1925.

level of the calcium in the blood and tissues. Every organ of the body has a depression of its function with a depression of the blood calcium and may be hyperactive when the calcium level is too high. Irritability of the nervous system is largely the result of imbalance of the body's mineral constituents. The neuralgias and forms of neuritis are in large part expressions of disturbed calcium level.

It is not so simple a matter, however, as is generally thought, as merely a measure of total calcium; on the contrary, the total calcium may be amply high and the animal or individual be perishing for want of available calcium.

Time does not permit an adequate review of even the major fundamentals as at present known. We at present determine five distinct calcium factors besides three relating calcium, inorganic and organic phosphorus. Of the total calcium of the blood stream, a part is in colloidal form as a proteinate (a globulin compound). This collodial calcium is nondiffusible: that is, it does not diffuse through certain tissues because the molecule is too large. Another fraction of the total calcium is diffusible and is available for tissue uses and chemical combinations. A certain factor including most of the diffusible, and generally some additional, is spoken of as active or ionic because it can readily take part in certain biologic reactions such as inducing the clotting of blood.

The inorganic phosphorus is, like the calcium, of fundamental importance. The product of the inorganic phosphorus and total calcium and the product of inorganic phosphorus and the active calcium furnish factors which directly express the level of the calcium balance and therefore a measure of the vital capacity.

An infected pulpless tooth in an individual causes, in greater or less measure, that which we have shown to occur in rabbits when an infected tooth is placed beneath the skin. This condition may exist for months or even years, constituting a menace to the calcium balance of the body and thereby undermining the defense or immunity without the patient or his dentist or physician having the slightest indication or even suspicion of the condition, on the basis of the former and largely current methods of interpretation; for such teeth in such individuals are not sore and may have little or no roentgenographic involvement.

We can learn much from the study of animals and thereby help in the interpretation of what we find in human beings. In Figure 12, an ordinary infected tooth was placed beneath the skin of a rabbit, and certain changes developed in the blood stream, particularly in the calcium and phorphorus. The total calcium progressively decreased during the first nine days, during which time the active calcium underwent a very great reduction, falling about one-half. Our previous experiments with large numbers of such animals have demonstrated that they die in convulsions when the active calcium is reduced to about 5 mg. An abscess had developed about the implanted tooth about as big as a hen's egg. The two lines showing total and active calcium balance both became depressed below the zero line.

The animal was given treatments, which time does not here permit the detailed explanation of, for the raising of its calcium. This resulted in a change of the levels of calcium balance

from below the zero line back to approximately normal, the swelling spontaneously decreased and the tooth slowly lowered. Unless its body is reinforced again by medication, it will succumb to the slowly overwhelming

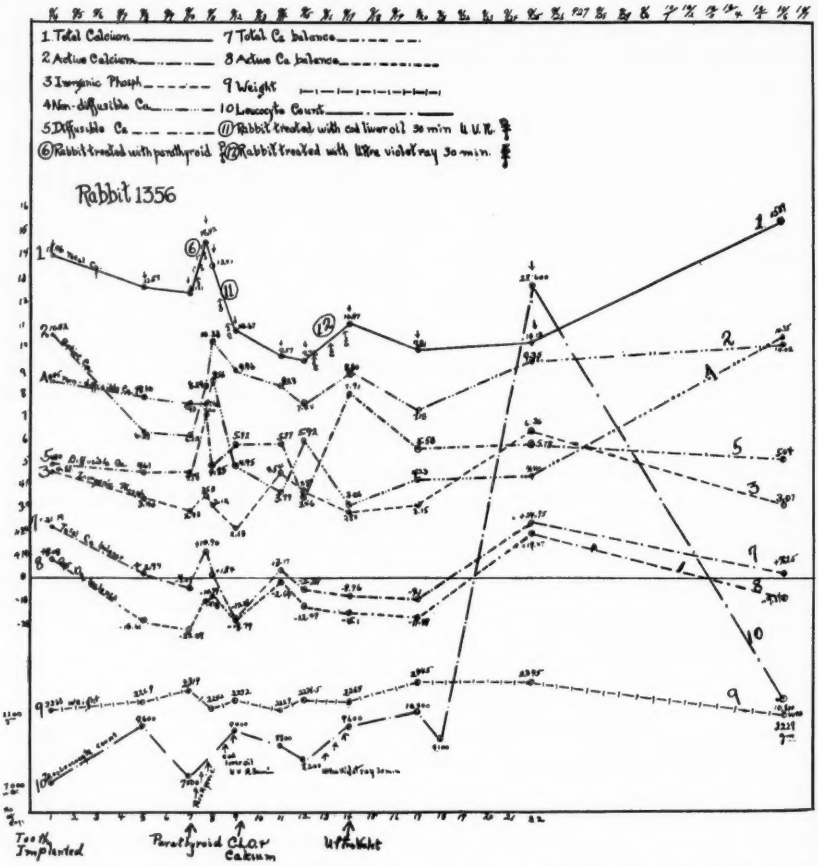


Fig. 12.—Changes produced in various blood factors by placing infected tooth beneath the skin of the rabbit: 1. Total calcium. 2. Active calcium. 3. Nondiffusible calcium. 4. Diffusible calcium. 5. Inorganic phosphorus. 6. Total calcium balance. 7. Active calcium balance. 8. Weight. 9. Leukocytes (Rabbit 1356). Note marked changes, especially of active calcium and response to treatments.

became encapsulated. The animal was temporarily rescued, as are many people. As time progressed, however, it lost in weight and its calcium balance was toxic infection which it has not the capacity to neutralize unless assisted from some outside source. Nature, in her heroic effort to hold up the depressing

calcium factors, proceeds to raise the total calcium. As in many people with infected teeth, the mechanism of defense in this animal is slowly but surely breaking, and it, like them, will become an easy prey to infection. The balance will always be determined in part by the contributing overloads. This animal, from the direction of the graphs, is doomed.

When we compare the record of this rabbit with the record of another (Fig. 13), which was similarly treated at the same time, we find, in general, the same progress except that, in the latter, the animal was not so rapidly

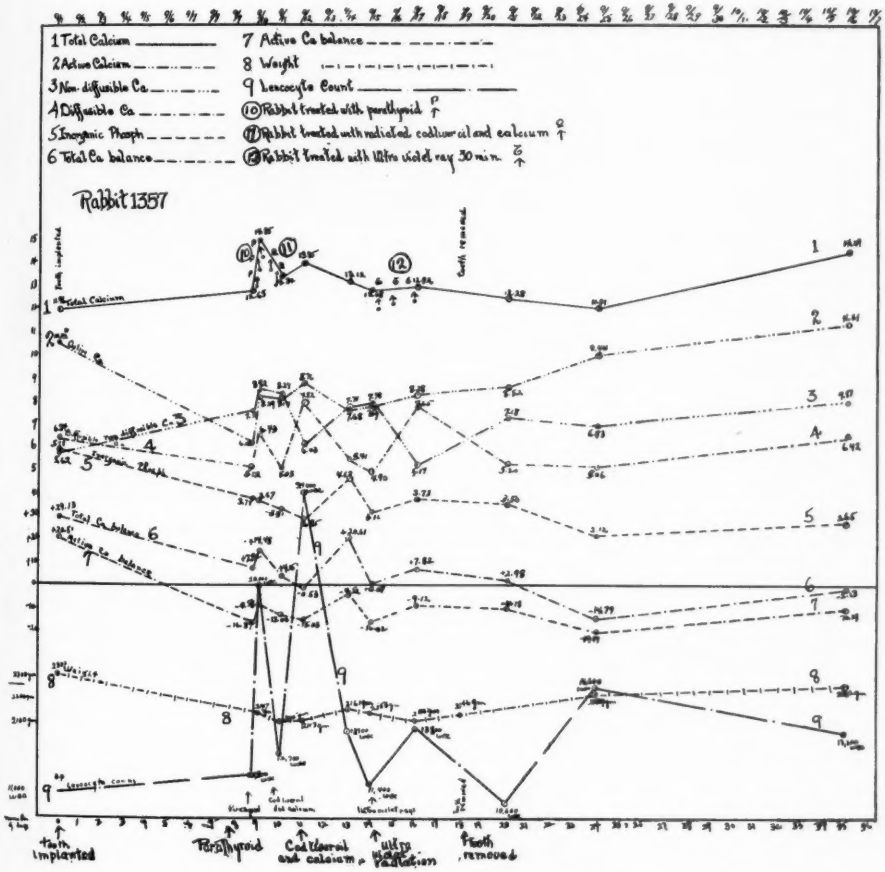


Fig. 13.—Rabbit 1357. Similar treatment to that shown in Figure 12 was given. The tooth was less toxic. Note rise in total calcium with fall of active calcium and rapid improvement with removal of tooth.

overwhelmed, and, in order to hold up the depressing various calcium factors, the total blood calcium was increased under treatment. The animal rallied, only to start declining again.

At this time, the infected tooth was removed from beneath the rabbit's skin, and it proceeded thereupon to show a change in all the blood factors. The negative calcium balance and body weight, and in fact all the various factors, steadily progressed back toward normal.

Those who do not understand the closeness with which pathologic pictures will be produced in human beings and in animals with like causes will not expect that we will so often see in our patients just such changes in blood stream chemical factors as have been produced in these experimental animals.

Time and space will only permit of one illustration, of which we have many. A patient suffering from neuritic pain in the right shoulder and digestive disturbance, which had been getting progressively more severe for two years, was at the time he came in virtually incapacitated. (Fig. 14.)

With the removal of chronic dental infection, there was, in ten days, the remarkable change shown in the chart. The total calcium increased from 11.7 to 12.5; the active calcium from 9.4

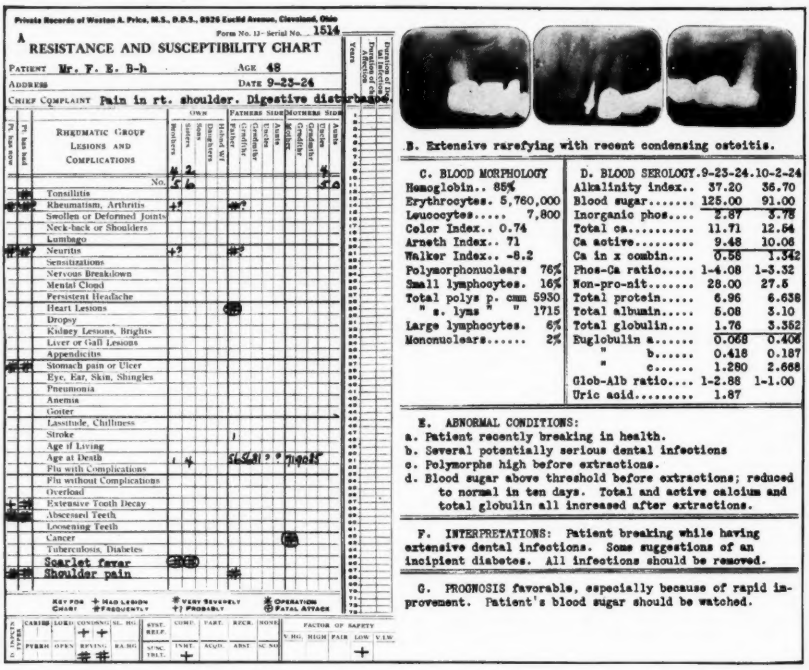

Private Records of Weston A. Price, M.S., D.D.S., 9926 Euclid Avenue, Cleveland, Ohio
Form No. 12 - Serial No. 1514
RESISTANCE AND SUSCEPTIBILITY CHART
Patient Mr. F. E. B-h
Age 48
Address
Date 9-23-24
Chief Complaint Pain in rt. shoulder. Digestive disturbance.
B. Extensive rarefying with recent condensing osteitis.
C. BLOOD MORPHOLOGY
Hemoglobin.. 85%
Erythrocytes. 5,760,000
Leucocytes..... 7,800
Color Index.. 0.74
Arneth Index.. 71
Walker Index.. -8.2
Polymorphonuclears 76%
Small lymphocytes. 16%
Total polys p. cmm 5930
" s. lyms " " 1715
Large lymphocytes. 6%
Mononuclears..... 2%
D. BLOOD SEROLOGY. 9-23-24. 10-2-24
Alkalinity index.. 37.20 36.70
Blood sugar..... 125.00 91.00
Inorganic phos.... 2.87 3.78
Total ca..... 11.71 12.64
Ca active..... 9.48 10.06
Ca in x combin.... 0.58 1.342
Phos-Ca ratio..... 1-4.08 1-3.32
Non-pro-nit..... 28.00 27.5
Total protein..... 6.96 6.638
Total albumin..... 5.08 3.10
Total globulin.... 1.76 3.352
Euglobulin a..... 0.068 0.406
" b..... 0.418 0.187
" c..... 1.280 2.668
Glob-Alb ratio.... 1-2.88 1-1.00
Uric acid..... 1.87
E. ABNORMAL CONDITIONS:
a. Patient recently breaking in health.
b. Several potentially serious dental infections
c. Polymorphs high before extractions.
d. Blood sugar above threshold before extractions; reduced to normal in ten days. Total and active calcium and total globulin all increased after extractions.
F. INTERPRETATIONS: Patient breaking while having extensive dental infections. Some suggestions of an incipient diabetes. All infections should be removed.
G. PROGNOSIS favorable, especially because of rapid improvement. Patient's blood sugar should be watched.

Fig. 14.—Typical blood-chemical change produced in a patient by removal of dental infection.

to 10; the inorganic phosphorus from 2.6 to 3.7; and the total globulin from 1.7 to 3.3. The blood sugar was reduced from 125 to 91.

With these changes, there has been a complete return to normal health. We have recently seen him and he reports that he returned promptly to business after the removal of the dental infection and for approximately a year has continued in good health.

The total calcium balance of this patient changed from a negative calcium balance of —7.3 to a positive calcium balance of +6.2, and the active calcium balance changed from a negative of 13.6 to a negative of 3. The globulin-albumin ratio changed from 1: 2 before, to 1: 1 after, which is approximately normal.

This remarkable improvement occurred in ten days after the removal of his chronic dental infections. It is of particular importance to note that this patient was suffering from digestive disturbance of increasing severity prior to the removal of the dental infection, and that this disturbance entirely disappeared with the removal of dental infection and he was able to return to a full, mixed general diet.

Similarly, a patient, 61 years of age, suffering from marked lassitude and physical and mental depression, experienced the following changes in his physical condition twenty-seven days after the removal of dental infection: The alkalinity index was raised from 33.4 to 36.7; the organic phosphorus, from 3.5 to 4.1. The nonprotein nitrogen, which was very high at 40, decreased to 30; the total calcium increased from 9.7 to 11. The active calcium, which was very low at 8.5, increased to 9.4. The total calcium balance, which was —4, increased to +5. The active calcium balance, which was —9, decreased to less than —1. With these blood changes, the patient's health so greatly improved that he considered himself well back to normal.

I hope I am making it clear, both that the disturbances of the normal levels of the chemicals of the blood are a part of the general condition, which we have been used to seeing chiefly or only as clinical symptoms, and also that, when these conditions exist for an extended period, they tend definitely to contribute to the degenerative diseases, though they may exist as disturbances and measurable changes in the blood stream for months or years before the clinical symptoms become manifest. When they do become manifest, they often constitute degenerative diseases so far advanced that even the removal of dental infection cannot correct them. The injury to heart and kidney tissue, for example, has been so serious that complete repair and complete recovery may be impossible, though it might have been prevented in part or in whole by removal of the dental infection before the secondary expression has seriously manifested itself in the essential organ. We are coming more and more to look on the degenerative diseases as symptoms of these various contributing factors.

This is the treatment indicated for our patients with infected teeth, if we would conserve what is more precious to them than even their natural pearls: those factors which determine the efficiency of their defense against overload and infection. This, in other words, is the time and the way an enlightened dental profession, enlightened by a new sense because it has a new truth, will treat heart disease, kidney disfunction, and general degenerative processes.

Dr. Buckley (in rebuttal): My friends, the thing that makes my opponent so dangerous is that which has been demonstrated here tonight. He

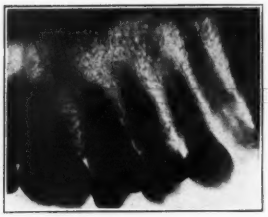


Fig. 15.—Eleven years after root-canal operation.

is absolutely impervious to criticism. He goes on and on, talking about something about which you know nothing, and when you get the time to look it up, you find he has left that subject and is working in another field, taking up another problem, or working on an entirely different phase.

Dr. Price has intimated here tonight that some germs are happy in formaldehyd preparations. I could throw on the screen dozens of cases to refute this statement. Figure 15 is from a case treated by Dr. Goslee, in which the pulp died under a filling. Dr. Goslee opened the tooth, treated and filled it without a roentgenogram, eleven years ago. When he found that this debate was going to take place, the roentgenogram for this figure was made.

Fig. 17.—At time of root-filling; formocresol in canal for eight months. Note bone regeneration during this period.

Figure 16 is from the practice of Dr. Louis E. Bake of Chicago. Dr. Bake opened the tooth in June, 1921, and, being seemingly unable to control the infection, he sealed formocresol in the canal and told the patient, a girl about 18 years of age, to have the tooth extracted. Instead of carrying out the instruction, however, the tooth being

Fig. 16.—Before treatment.

Fig. 18.—Eleven months after root-filling.

comfortable, she forgot all about it for about eight months, when she returned and asked if she must really have the tooth extracted. He told her that he

Fig. 19.—Two years and eleven months after root-filling.

thought she must. However, he looked at the tooth, and the gums seemed healthy. Then he took out the dressing, which was odorless and dry, filled the root, and had a second roentgenogram taken (Fig. 17). This was done in February, 1922. During these eight months, let it be remembered, the formocresol was in the canal all the

Fig. 20.—Before treatment.

time. This is not from my practice but from that of Dr. Bake. It was roentgenographed again in January, 1923 (Fig. 18), and still later, in January, 1925 (Fig. 19).

Dr. Price implies that bone will not regenerate when preparations such as formocresol have been used, and that germs can and do accommodate themselves and are happy in such strong disinfectants as formaldehyd is known to be. Surely there is something wrong somewhere.

Fig. 21.—One month later, immediately after root-canal operation and filling.

The next case is from the practice of Dr. Charles G. Hartley of Los Angeles. I was consulted in the treatment of the case, and, if I remember correctly, both Dr. Hartley and I advised extraction. The patient demurred, and Dr. Hartley undertook the treatment. The roentgenogram for

Fig. 22.—Fourteen months after root-filling.

Figure 20 was taken in October, 1922. The canal was filled in November, 1922 (Fig. 21). The tooth was roentgenographed again in January, 1924 (Fig. 22) and again four days ago, Oct. 8, 1925, as shown in Figure 23. Dr. Hartley used formocresol in treating this tooth, bone regeneration resulting as shown by the illustration.

Fig. 23.—Nearly two years after root-filling.

The next case (Fig. 24) was treated by Dr. Fred W. Gethro of Chicago. The patient at the time, 1916, was a junior student at the Northwestern University Dental School. As many of you know, Dr. Gethro does not use any drugs at all in his treatment, depending entirely on mechanics. He cleaned the canals and filled the roots (Fig. 25), and the following day Dr. George W. Meyer amputated the root ends and curetted the area. (Fig. 26.)

Fig. 25.—Immediately after root-filling.

Subsequently, this patient served twenty-seven months in France, during the World War. On his return home, the picture for Figure 27 was taken. The last picture, Figure 28, was taken in October, 1925. The patient, Dr. S. B. Barteau, is now practising on the west side in the City of Chicago.

Fig. 24.—Before treatment.

Fig. 26.—Immediately after surgery.

I could show many more cases, and I have evidence in my pocket from pathologists that would prove to you that almost every statement made in Dr. Price's two books are based upon

admittedly insufficient data; but there is no need of my giving the evidence to you here tonight. It would do no good as far as Dr. Price is concerned, and I will not take your time at this late hour to go into that phase of the subject, which I could easily do. I repeat that he is an unsafe leader in the scientific field.

Dr. C. N. Johnson,[12] one of our past presidents of the A. D. A., and our presiding officer tonight, classifies this wave of extraction of pulpless teeth among the "fads." If this proves to be a fad, no other of the many in dentistry has left such direful results in its wake. In medicine, such things have happened. Twenty-five or thirty years ago, the miscellaneous removal of ovaries was considered by many as legitimate surgical practice. One prominent surgeon of Chicago, and he was only one of many, had a good sized room in his suite of offices where he proudly displayed his ovarian specimens, which nearly filled the room. On one occasion, he showed these specimens to a Denver dentist, a boyhood friend. Just a few years later, when the dental friend made another visit, no mention was made of the display room; it had disappeared, and our friend asked about the specimens. Whereupon, the surgeon replied, "My God! man, don't mention them. I would give ten years of my life if I could put those ovaries back." This surgeon was honest and thoroughly conscientious, as I credit most members of my profession with being. He recognized his mistake. He died just a few years later, a comparatively young man. It was about this time that the American Medical Association was meeting in Atlantic City. The great surgeon, the late Nicholas Senn, was scheduled to deliver an address. The subject announced was the "Unsexing of Women." The hour came, the room was packed. Many nearby surgeons had brought their women patients with them to hear from the lips of the recognized master surgeon of the day the justification for the operation they had performed or had recommended. But instead of justifying the operation as so generally performed, Dr. Senn branded it as absolutely criminal.

Fig. 27.—About four years after operation.

Fig. 28.—About nine years after operation.

12. Johnson C. N.: Fads and Their Effects, J.A.D.A., 12: 635 (June) 1925.

These men left with their patients, feeling like the dog who had killed the sheep. If there ever was a time in dentistry when we needed a Nicholas Senn, that time is today. Anesthesia was given to the world by a dentist, and it has been one of humanity's greatest blessings; but in the hands of many, it has often been a curse. We do not need to search far for at least one cause for the large and growing group of intelligent men and women who have lost faith in all operations and all medicine.

I am making no plea for the hopeless case, or even for those teeth that are in doubt or questionable, but I am pleading with you as men and as dentists not to frighten patients over matters concerning which you are not certain. Do not advise the extraction of pulpless teeth just because they are pulpless, or on purely roentgenographic or laboratory findings, with no clinical evidence that the teeth are causing systemic trouble. Why not leave some of the responsibility with the patients, without frightening them beyond all reason? Let us go slowly and cautiously in these matters until we are more certain of our ground than we are at present. When there is evidence pointing to infection, however disclosed, it is plainly the duty to recommend that such infection be eradicated, or the evidence refuted or proved incorrect. This is all the physician should ask. How it shall be done, the medical man should be, and in most instances is, willing to leave to us.

I know of the hazards and difficulties that are encountered at times in root-canal surgery; you know that I do. I know that we have been quibbling over nonessentials in methods of treatment; also, how easy it is to recommend extraction to get rid of the infection, and the ready fee in sight for the replacement of the lost teeth by fixed or removable bridges, partial or full dentures. I know also that my profession is bewildered and confused. That was my only reason for challenging my opponent in this debate. I know, too, that dentists, with few exceptions, are sincere and honest. To be confused is not to be dishonest. I plead with you to be cautious and considerate. Truth will ultimately prevail. In the meantime, let us stand back where we can see above and beyond the clouds; where we can observe the radiant sunshine with its stimulating rays and its elevating influence, and from this vantage point, my friends, we will find dentistry towering among the learned professions of the day, strong and fearless, rendering a worthwhile service to a pleading, an innocent and helpless humanity. I thank you.

Dr. Price (closing): If, now, we summarize these various presented data, we find that:

People are not living nearly to the entire span of life which they have a right to expect:

Death is occurring even in our most civilized communities largely from the degenerative diseases, chief of which is heart disease.

Even the mortality statistics of our various communities will at this time give an indication of the level and thought of dental practice with regard to the management of infected pulpless teeth.

It is practically, if not entirely, a physical impossibility to sterilize infected cementum by treating through

the dentin. It is like trying to sterilize infection in the label on the bottle by putting disinfectants in the bottle.

Root fillings do not continue to fill root canals. The amount of space that ultimately develops is approximately the amount of solvent that was used with the root-filling material, assuming that mechanical filling of every area was possible.

Individuals are not comparable in their defense against degenerative diseases. Some are susceptible and must have an entirely different preventive program.

The degenerative diseases are largely symptoms of degenerative processes in the blood stream, an important contributing cause for which is long-continued, usually unsuspected, chronic infection.

The extremely inadequate time and space for this statement prevents the inclusion of similar important evidence, demonstrating that:

The roentgen rays cannot reveal all the required information, and under old standards will often be misleading.

The complement fixation method for dental infections can be related to systemic sensitization.

Chronic dental infections reduce the normal bactericidins of the blood.

Leukocytic activity is depressed by chronic dental infections.

Chronic dental infections can produce antigens, to which the sensitized patient may respond with an allergy of severe and very obscure type.

Dental infections can be demonstrated to have had specific localizing ability for many of the organs and tissues of the body. I have already reported on most of these in my papers and books.

We cannot, therefore, continue in the light of these new truths to give any quarter to the infected pulpless tooth until we can both accomplish its disinfection and insure its continued sterility. Until then, it must be eliminated. By the elimination of dental focal infections, we will eliminate one of the important contributing factors to the shortening of life and loss of health, for it is chiefly the destructive influences of these infection products that have to do with the destroying of the defensive mechanisms of the blood stream and the producing of abnormal levels, chiefly of calcium, which thereby predispose to sensitization reactions, cancer, tuberculosis, diabetes and the anemias, on the one hand, and to the rheumatic group of degenerative diseases on the other, two groups which together constitute the great majority of deaths in the various communities.

A new truth is a new sense, for, with it, we can see things that we could not see before and things that cannot be seen by those who do not have that new truth; but a new truth comes only to a prepared mind, and for those of us who have in some degree a prepared mind, we are able to say with Ross, for we can see with this new truth the thing that he could see when he found a means for relieving malaria:

> This day relenting God
> Hath placed within my hand
> A wondrous thing; and God
> Be praised . . . .
>
> I know this little thing
> A myriad men will save.

In closing, I want you to see with me a little incident that happened in a town in Illinois, a year ago last Christmas. Prior to that time, there had been appearing, in a window, a little hand that seemed to wave to each passing

train as if in distress. At night, a flickering match took its place, and it was waved frantically as a signal for help.

This got on the nerves and hearts of the trainmen as they passed by; and as they exchanged reports, they decided that there must be someone there in distress. Accordingly, a committee was appointed to go and investigate; and it was found that a little bedridden child lay crippled where she could not see out of the window but where she could reach her hand in front of the window.

On Christmas morning, two transcontinental express trains stopped on the main line in front of this little home, and from them committees of trainmen proceeded to the little home to carry comforts and money to help this afflicted little sister of humanity.

I do not know what she was suffering from, but I do believe that there are many such sufferers who have been an important, if not a controlling, contributing factor in dental infections, and I am going to ask that every time you place a root-filling in an infected pulpless tooth, you shall see that hand waving in the window.

Ggolf

By C. N. JOHNSON

(Delivered before the American Dental Golf Association, Louisville, Ky., Sept. 20, 1925)

GOLF is not a game—it is a religion. It is not an institution—it is a fraternity. It is not recreation—it is sanctification. Born in the better impulses and the dire necessities of man, it at once became his relaxation and his redemption. Men begin it with canny concern, but they never end it—there is no end. It is limitless as the canopy of heaven, and as broad as the world is wide.

Golf is the great emancipator. It takes men out of the turmoil of life, and frees them from the cares of the work-a-day world. It is the epitome of pleasure and the acme of delight; it is at once the despair and the hope of our modern civilization. It is virile as the raging tempest, and as gentle as the softly sighing wind, or the wooing of the turtle dove at early morn. It is the elixir of life, the rejuvenator of the soul. It is the tamer of the wildest temperament, and the inspiration of the most phlegmatic. It is the great harmonizer, the great leveler, the great equalizer. It makes of the prince a peasant, and of the peasant a king of the realm.

In the bright lexicon of golf, there is no such word as failure and no such word as perfection. It is elusive in its whimsicalities, and certain in its uncertainties. It absorbs the souls of men, and makes of them the slaves and kings of destiny.

To cope with its intricacies and perplexities is to achieve a liberal educa-

tion; to master its vocabulary is to outdo the dictionary. To utter a swear word is not profanity—it is consecration—it is merely a vent or a prayerful emphasis. To be tired is not to be weary—it is to be rested and refreshed. To be defeated is not to be beaten—it is to triumph and to exult.

To saunter out in the clear crisp air and drink in the pulsing glories of the morning sun, or revel in the tender moods of the receding day; to chase the errant ball in its random flight and watch its wild gyrations with anxious mien; to train the eye, the hand, the nerves, the mind; to test the temper and to try the soul; to suffer defeat and to achieve triumph, and to accept both with equal grace; to ascend the heights and to sink into the depths; to battle with the wind and the rolling sward; to tread the springy, velvet fairway green, and hear the happy songs of birds; to thrill with the whir of the bullet ball as with the rustle of phantom wings; to forget men and gods and to be attuned to the glorious air and earth; to be intoxicated with the ether of the atmosphere, and be tamed by the smell of turf; to feel tingling in your finger tips the test of brain and brawn; to shed the carking cares of life and step blithely into the purer, rarer realm of the blest; to be one with all mankind, and with the hills and vales and running brooks; to drink at the ever-flowing fountain of youth, and to be transported to the ethereal heights of fair Olympia; to achieve the very joy of life and learn to live and love, and work and play—all of this and myriads more is embodied in the blessed creed of golf.

DEPARTMENT OF DENTAL HEALTH EDUCATION

WHAT BACTERIA DO IN THE MOUTH*

(Compiled by The American Academy of Periodontology, September, 1924)

Bacteria, which are everywhere, are man's best friends and his worst enemies. Without bacteria, there could be no higher forms of life as we know them, because dead organic matter would not decay, and therefore the simple elements would soon be used up. Let us suppose there were no bacteria to cause the decay of fallen leaves, of dead grass and other vegetation. The heaps of dead matter would accumulate and the soil would become exhausted because growing matter would be constantly taking elements from the earth and returning nothing to it. This large group of useful bacteria we recognize as friends, while a much smaller group we have learned to identify as our enemies. These bacteria appear too efficient and are always trying to break down organic matter before it is really dead. Those that attack us in this way we call disease germs, or pathogenic bacteria.

BACTERIA IN THE MOUTH

Bacteria are always present in the mouths of people from the first day of life. They multiply and develop wherever there is dead organic matter to decompose, together with warmth, moisture and darkness. The mouth offers the last three requirements for bacterial growth perfectly, and usually there is sufficient accumulation of food particles, stagnant saliva, mucus and other material lodged between the teeth and coating both them and the tongue, to furnish the dead organic matter on which the germs live.

TYPES OF BACTERIA

There are many types of bacteria in all mouths and, of these, only a few may cause disease if the natural resistance of living tissues is lowered enough to allow them to penetrate.

a. *Staphylococcus (Bunch of Berries).*—This germ was thus named because, under the microscope, it looks like a bunch of berries. This is the organism that causes pimples and boils, and pus infections. When the staphylococcus infects a tissue, that tissue is turned to liquid as it

*Bulletin No. 4. This is one of a series on the teeth and their care prepared for the information of the public.

is digested by the germ. The staphylococcus makes up about one-fifth of the germs on the teeth.

b. *Streptococcus (Chain of Berries).*—This germ, also, was so named because of its appearance under the microscope. There are many varieties of streptococci, several of which may cause disease when the tissue resistance is lowered and they get into the body. One variety is found abundantly on the teeth, making up nearly one-half of all the germ life. This particular kind of streptococcus has the ability of penetrating into living tissues without causing much inflammation. It may develop in sheltered spots in the tonsils or find a breeding place at the root ends of devitalized teeth (teeth with dead pulps or nerves). It adapts itself to the fluids of the person it is attacking and finally is carried away in the blood stream to other parts of the body, where it may find conditions favorable to its growth and eventually be a cause of disease in that part. Rheumatism, appendicitis and certain diseases of the eyes, heart, kidney, stomach and gallbladder can, it is believed, sometimes be traced to infection by the streptococcus.

This germ also has the power to take up the starch or sugar left in the mouth and turn it into acid. This acid, in turn, dissolves the lime salts of the teeth, and cavities form.

c. *Other Bacteria.*—Besides the staphylococcus and streptococcus group, there are several other kinds of bacteria in the mouth, as well as molds and yeast, some of which can etch the enamel and form cavities.

NUMBER OF BACTERIA IN THE MOUTH

A milligram is the smallest weight used on the finest scales. A piece of ordinary paper one-eighth inch square weighs a milligram. One milligram of the soft deposit scraped from the teeth of a person who keeps his mouth very clean will contain about 6,000,000 bacteria. When the teeth are allowed to get dirty and the bacteria can multiply undisturbed, this number rises until a milligram of deposit may contain 600,000,000 or more bacteria. No wonder the gums next to such a rich growth of bacteria became inflamed and bleed.

RESISTANCE TO BACTERIA

Bacteria are present everywhere. The staphylococcus may be procured anywhere at any time on the skin of the body. But it does not penetrate to cause pimples and boils unless the skin is damaged by chafing, or unless the vitality of the whole person is lowered by overwork, lack of exercise or constipation, or from some other cause. Freedom of the body tissues from infection depends on two things: (1) their own vitality; (2) cleanliness, assuring a small number of bacteria.

1. *Tissue Vitality.*—It is not enough to keep the bacteria in the mouth reduced to the lowest possible number. The tissues must be kept in condition to resist the germs. Four factors contribute to high resistance:

a. Teeth well formed and jaws well developed by proper attention to diet and mastication in childhood.

b. Vigorous use of the teeth and massage of the gums by thorough chewing of harsh, coarse food, and by use of the toothbrush.

c. Freedom from mechanical injury, such as undue stress that shifts the tooth from its position and batters and bruises its attachment by constant movement; from injuries resulting from careless use of toothpicks and from food crowding between the teeth and pressing on the gum, and from incorrect dental restorations.

d. Good general health. The health of the teeth and their tissues varies with the health of the rest of the body. One great cause of lowered resistance of the tissues of the body to disease is constipation.

2. *Cleanliness and How to Achieve It.—a.* Brushing. Cleanliness of the teeth is not just a matter of hard brushing, although it may be accomplished in this way. The teeth should be brushed immediately after rising in the morning and after each meal. (Previous bulletins give instructions on how to brush the teeth.)[1]

b. Correct eating. The most important factor in keeping the teeth clean is moderate eating. It has been found that, in overeating, a heavy deposit flows out in the saliva an hour or two after the meal and coats the teeth. This deposit contains lime salts, which form the calculus on the tongue side of the lower front teeth and at the other points on the crown surfaces. This coating forms a fine place for bacteria to grow.

Everyone has had the experience of eating just before retiring, cleansing the mouth thoroughly and then getting up in the morning with the teeth and mouth thickly coated. This is a signal that more food is being eaten than the body can use. The excess is food for bacteria that injure the health.

Coarse food, well masticated, especially uncooked vegetables, scours the teeth and has a cleansing effect. Well-baked bread, toast or zwiebach made with the whole grain cereals are good for this. Absence of pasty food helps to keep the teeth clean. Acid fruit tends to break up mucus on the teeth and flush it away, and with it go the bacteria and food particles it contains. Meals should end with a salad or fruit rather than with cake or pastry. The teeth will then be much cleaner at the end of the meal.

It is possible to keep the bacterial growth low in the mouth and the teeth clean by attention to diet alone, but it would be unsafe for most persons to try it. Modern living conditions make a rigid toothbrush régime a necessity.

1. Children's Teeth—How to Use and Keep Them, J.A.D.A., 11: 450 (May) 1924.

THE PART THAT BACTERIA PLAY IN DISEASES OF THE TEETH AND THEIR SUPPORTING TISSUES

Dental Periclasia (Gingivitis and Pyorrhea).—The magazine advertisements of today are full of warnings against "pyorrhea," but it is doubtful that many readers have any real understanding of what this condition is. The word pyorrhea has come to be used rather loosely in connection with a diseased state of the tissues supporting the teeth. It means a flow of pus, so there must be a flow of pus from the tissues that surround the teeth if pyorrhea is present. Of course, pus-producing germs have to be present to cause pus to form, but the disease of the tissues commonly known as pyorrhea is the result of several causes all working together, of which germ activity is but one. Before disease occurs in these tissues, their vitality and resistance to the invasion of germs must be lowered.

This is what happens in the development of the more frequent diseases of the supporting tissues of the teeth that are grouped under the general head of dental periclasia, meaning a breaking down of the tissues about the teeth. The gingiva, or gum tissue, after its vitality has been lowered, is overcome by the immense number of disease-producing bacteria lying against it, and finally the protective, covering skin or mucous membrane is penetrated by the germs, and gingivitis or inflammation of the gums results. The invading germs still further break down the vitality of the tissue, form pus and dissolve the attaching tissue of the tooth root, thus leaving a space between the root and the overlying gum. Thus pus pockets are formed, extending deep down under the gum. After a time, so much of its supporting tissue is destroyed that the tooth is loosened and, if not cared for, is eventually lost. Probably as many teeth are lost from pyorrhea as are lost from decay. When the mucous membrane of the gum is lost next to the tooth, a fluid issues as from any open wound. This fluid contains lime salts, which gradually accumulate on the teeth surfaces below the line of the gum and form a dark, hard coating, known as calculus. This calculus, which is porous and rough swarms with bacteria, so that it greatly aggravates an already bad condition. Another variety of calculus, or tartar, yellowish in color, is deposited on the exposed surfaces of the teeth by the saliva.

TREATMENT OF DENTAL PERICLASIA (GINGIVITIS AND PYORRHEA)

Each of the causes of a diseased state of the supporting tissues of the teeth should be removed as far as is possible. One of the first steps in the treatment is to relieve the teeth from any excessive strain or use and then to have the calculus removed and the teeth cleaned and polished. Then, by careful treatment at home, the teeth must be kept immaculately clean and the gums massaged to build up the circulation and vitality in the surrounding areas until the bacteria are driven out and health is restored. The scaling and polishing of the roots of the teeth in such a case is one of the most difficult operations in dentistry, requiring special instruments and special practice. This treatment must not be confused with the ordinary "cleaning," which merely removes the deposits from the

exposed surfaces of the crowns of the teeth and makes no attempt to go below the gum to remove deposits collected on the root surfaces. By careful treatment, health may be restored and the pockets closed, but all the lost alveolar process does not come back and the tooth is never so strong as it was originally.

DENTAL CARIES (DECAY OF THE TEETH)

Decay of the teeth is not so well understood as inflammation of the gum (gingiva). This is the simplest explanation: Sugar or starch collect in the spaces between the teeth and in little grooves, where they are protected from the diluting and washing action of the saliva. Here, the bacteria cause them to ferment and form an acid, which gradually dissolves away the enamel of the teeth until the bacteria and acid can reach the softer dentin inside. The dentin is rapidly attacked, and the enamel is undermined and chips out, exposing a cavity.

CAUSES OF DECAY

Decay is the result of:

a. The presence of food containing sticky starch and sugar in the mouth for hours at a time. Much candy usually means much decay.

b. Fissures or ridges in the teeth. Perfectly formed teeth in a regular line do not offer much foothold for bacteria causing fermentation.

c. Lack of lime in the body.
Periods during which there is an unusual amount of lime required by the body are periods of susceptibility to dental caries (decay). Such a period occurs during pregnancy or lactation (nursing period). The food should then contain additional lime. (Bulletin No. 1.)[1] The growth period of children is another time of susceptibility. So, also are times of illness. Individuals vary in susceptibility, and the diet and manner of living should be planned accordingly.

WHERE DECAY OCCURS

In children, the pits and fissures in the grinding surfaces of the teeth, especially the first permanent molars, are most frequently attacked; after this, the surfaces between the teeth; next, the surfaces near the gingiva (gum), on the cheek and lip side.

In the fissure cavities, there is frequently a complete loss of the underlying dentin, and the pulp is exposed before the enamel breaks away sufficiently to make a cavity noticeable. That is why it is so important for children to have their teeth examined every few months; for when the decay reaches the pulp, the tooth is practically doomed. The seriousness of the loss of a first molar has been described in a previous bulletin.

PULP INVOLVEMENT

Sensitiveness to cold or to sweets in a tooth usually means that decay has occurred. It is very important to have the cavity immediately filled. If this is neglected until there is a severe tooth-ache, the pulp (nerve and blood vessels) will probably have to be removed or the tooth will be lost. Either is deplorable and should by all means be avoided.

DENTAL ABSCESSES

In the past, it was considered good dental practice to remove a decayed pulp and fill the cavity with an antiseptic material. Although this method is still practiced by many dentists, it is always avoided if possible. The use of the roentgen ray in dentistry for the last ten years has shown that teeth so filled are frequently unhealthy because bacteria continue to live in the pulp canals and emerge from the little openings at the root tips to cause disease in the surrounding bone. These little chronic abscesses may form pus, associated with swelling and pain, but usually they develop so slowly that their owner is not aware that anything is wrong. There may come a period of low vitality, due to illness or fatigue, and the bacteria gain such headway that they cause a more acute condition. A gum boil may form or an acute abscess develop, with much pus and swelling of tissues.

FOCAL INFECTION

If the danger of local discomfort were the only thing to be considered, bacteria in the mouth would not be so serious. But these germs in the abscesses get into the blood stream and are carried to all parts of the body. They adapt themselves to the living fluids of the body, and can develop points of infection (focal infection) and disease in other parts of the body. The most common of these diseases is rheumatism, now believed to be almost wholly an infectious disease. It may take the form of arthritis (rheumatism of the joints), myositis (rheumatism of the muscles) or neuritis (rheumatism of the nerves). The heart and kidneys, the appendix and gallbladder, the stomach or the eyes may be involved. Or, if actual disease is not caused, these mouth bacteria (the streptococcus in particular) may lower the vitality of the person until the victim becomes a prey to tuberculosis or some other invading germ. They sap the vitality and make the person lose "pep." The child with abscessed teeth may be fretful, dull, listless, backward in school, always having colds and a burden to his parents and the school.

The economic loss to the United States because of this germ (the streptococcus) probably runs well into the billions of dollars since, from many causes, most of which are preventable, the tissues of our bodies are lowered in vitality and this germ is given an opportunity to flourish.

PREVENTION OF DENTAL INFECTION

Nearly all of the conditions described above are preventable. If the teeth are properly cleaned, and frequently inspected and cared for, bacteria will not invade the gum. When the teeth are frequently examined and properly filled, the pulp is seldom involved. When decay has reached the pulp, many dentists are convinced that the tooth should be extracted and the space bridged at once, if possible. Others believe in treating the root canals and trying to keep the tooth healthy. The decision as to the proper course must be left to the dentist, in consultation with his patient and the patient's physician.

STORE DENTAL SERVICE

By ARTHUR B. EMMONS, 2nd,* M.D., Boston, Massachusetts

(Read before the Massachusetts Dental Society, Boston, May 7, 1925)

THREE-fourths of all store workers are in immediate need of dentistry if we may judge by the first 2,600 patients seen in three store dental clinics in Boston in the last two years. A large number of dentists, mostly recent graduates of two leading dental schools, have applied for part time work in these clinics, and, in addition, many dental hygienists have applied for positions.

This article explains why the demand for and the supply of dental service have not been brought together and suggest how the organized store dental clinic effectively supplies this needed connecting link in one important field of community life.

THE NEED

The stores having clinics report their two years' experience with a total of 2,605 cases diagnosed and recorded in three classes.

Clean mouths were found only in two-tenths (19.9 per cent) of the 2,605 people coming voluntarily to these clinics.

Fair mouths were found in about five-tenths (53 per cent) of those examined. These required not only prophylaxis but small fillings and simple extractions. All such work may fairly be called "preventive"—that is, work done to prevent gross decay with pain, loss of teeth and systemic disease, all of which result in loss of time and human energy.

Neglected mouths, found in three-tenths (27.1 per cent) of store workers voluntarily applying at our three clinics, fall into a third class. These mouths require thorough inspection, careful appraisal of the possibilities of reconstruction, a planned sequence of procedures and finally an estimate of time, materials and cost. With this professional data obtained, the individual with a mouth coming under Class 3 must be appraised as to his desire to improve his mouth condition, his ability to pay for the service and his willingness to cooperate and continue treatment to a satisfactory conclusion. Such cases are then referred to private dentists or suitable clinics, according to the patient's means, and are carefully followed up.

Cases of dental emergencies and the "dentally sick" are found mostly in this third class. Here, improved health and vigor and the reduction of systemic disease may reasonably be expected to follow in proportion to the improved local condition. These cases take much time, and the patients cooperate poorly and are less capable of paying the costs, but are in greatest need.

CREATING THE DEMAND

Our experience thus shows that about 75 per cent of the workers hesitate to have dental work done. It seems easy to postpone this uncomfortable duty. They are either unwilling or unable to

*Director, Harvard Mercantile Health Work.

obtain satisfactory service. To meet this situation of ignorance and neglect, it is necessary to organize an aggressive campaign of education and to supply an acceptable service. The essentials of a popular dental service we have found are: first rate professional work; a dentist with a pleasing, tactful personality; convenience in time and place, and cost within the means of the individual. The three store clinics here quoted have from the start been filled to capacity, and all have enlarged their service in an attempt to meet an ever-increasing demand.

An effective means to counteract the tendency to neglect the necessary attention to the teeth is a well organized system of appointments, with a penalty if they are not kept. Further appointments are made and followed up by telephone. Dental service in stores on store time helps wonderfully in carrying out this health procedure.

The private dentist, to whom serious or extensive cases are referred, soon finds that such clinics greatly increase private dental practice by teaching the public the value of good dentistry. He soon welcomes such neighboring clinics.

Dental Clinic in a Boston store with 1,500 employes.

SCOPE OF WORK

Emergencies — toothaches — are treated immediately. Such cases are followed up and, at the discretion of the dentist, the teeth are cleaned in the

clinic or the patient is referred to a private dentist or dental clinic doing satisfactory work.

Preventive dentistry — prophylaxis, simple fillings and extractions—should be offered to permanent employes at cost.

Roentgen-ray diagnosis should be available, preferably in the store clinic, but outside if necessary. When such processes can be carried on satisfactorily in the clinic, much time is saved by all concerned. A half day usually is lost from work to get one hour's private dentistry. The accompanying table presents a schedule of procedures delimiting the work and giving the cost in these pay clinics.

ESTIMATED COST OF STORE DENTAL SERVICE

	Material	Time Min.	Labor	10 per cent Int. & Deprec.	Total Charge
Amalgam fillings (simple)	$0.25	30	$1.65	$0.20	$2.10
Amalgam restoration	0.38	45	2.50	0.29	3.17
Synthetic porcelain	0.38	35	2.00	0.24	2.62
Cement	0.15	30	1.65	0.18	2.00
Cement and amalgam	0.38	45	2.50	0.29	3.17
Pyorrhea treatment (first)	0.50	60	3.35	0.38	4.23
Pyorrhea treatment (others)	0.25	30	1.65	0.20	2.10
Emergencies	?	per hr.	3.35	?	3.35
Cleaning	0.05	45	2.50	0.26	2.00
Extractions (first)	0.13	30	1.65	0.18	2.00
Extractions (each additional)				0.05	0.55
Root treatment	0.05	30	1.65	0.17	1.90

FINANCE

Free dentistry is not appreciated, nor is it self-respecting. It teaches the habit of dependency. The stores have therefore adopted a system of fees at cost.

They have been willing to encourage the formation of clinics by paying the initial equipment (about $1,500) and installation cost, giving space, heat and light for the clinic, and the time off for attendance of the worker at the clinic.

The running cost has been paid by fees. This cost, in one store dental clinic, with a dentist only, for a period of six months, proved to be $3.70 an hour. The dentist's salary was at the rate of $10 for three hours' work. The balance was due to cost of materials and lost time. The mutual aid association voted to charge $3.75 an hour.

To do this work, it was suggested that a dentist be employed for three mornings a week, three hours each morning, that is, thirty-six hours a month. The city dentist, it must be borne in mind, has an overhead cost for his office estimated at 50 to 60 per cent of his gross receipts. This overhead cost largely continues even when his office is not in use, as when he is employed on a part-time job. Taking this overhead into consideration, an experienced man of the right type should be worth $10 a half day. The labor charges are figured on a basis of $3.35 an hour.

SELECTING A DENTIST

The dentist will prove successful provided he possesses, first of all, technical knowledge and skill, judged by the standing of his dental school and his standing with its instructors who

trained him. They alone are qualified to estimate his technical ability. The holding of an instructorship is the best guarantee of the ability of a dentist that can ordinarily be obtained. Recommendations of a dentist's own patients are of little value as regards his professional capabilities.

After his professional ability, his personality, self-confidence, thoroughness, care and dexterity, together with a sympathetic understanding of his patients, are to be considered; adding to these qualities one more essential: some executive ability in planning his time and carrying on effectively a followup system of his own and his referred patients. This will save time for his patient and for the store.

Teaching mouth hygiene to his patients should be a duty and pleasure to the thoughtful dentist.

The dental hygienist or dental nurse trained to clean teeth properly fits in well with the need of a store dental clinic. Few people are awake to the advantage of employing a dental hygienist for proper cleaning of the teeth every three to six months.

As a member of the dental service, the dental hygienist will act as assistant and save time for the dentist. She will serve as the clerk making appointments, and keeping records and reports. She is largely responsible for the smooth running of the clinic and the effectiveness of the followup system.

REFERRED DENTAL CASES

What happens to the individual needing dentistry beyond the capacity of a store clinic? Who does the extensive extractions, plate work, prolonged root canal treatment, etc.?

Jennie D., a salesgirl, was one of the first patients at a newly opened store clinic. Jennie had read a sign on a down-town dental parlor "$5 for a complete set of teeth." After some painful weeks, she was fitted with a plate costing her $45. The store dentist found this plate so badly made and ill fitting that it was painful and useless. He stated that an efficient one could be made at a cost of $15. Properly organized store clinics should prevent many such experiences of ignorant workers.

PROFESSIONAL ETHICS

The store dentist to whom his patients' good is the first consideration will refer each patient to the private dentist, dental clinic or dispensary where that patient will get the best service within her means.

For those workers in higher positions, a private dentist of known ability will usually answer the requirements.

For the many workers of the rank and file to whom fees of from $8 to $10 an hour would prove an obstacle, some other arrangement must be made.

To meet this common need, a special clinic was arranged by an agreement with the Harvard Dental School, which agreed to maintain a clinic for needy store employes, to have only graduate work done and on a cost basis similar to that of the store clinics.

The store agreed to underwrite their own employes' cost so that the dental school should not lose money. Patients were charged on a scale similar to that in effect in the store work.

CONCLUSION

Preventive medicine offers no more generally needed or more effective health measure than dental service.

Only about two in ten people employed in stores were found to take adequate care of the teeth and to show "clean" mouths. Three in ten had "neglected" mouths. One dentist in a

store with a force of 4,000 spent three hours every morning caring for nothing but emergencies.

The store without a dental clinic usually allows a worker to go to a dentist on store time. A visit to a private dentist for an hour's work results usually in the loss of a whole morning or afternoon.

Dentistry, therefore, is needed. More than two years' experience in three store clinics shows that dentistry is wanted, provided it is of a high character, convenient, on store time and within the means of the patient. The chief essential is a capable dentist, who is considerate and thoughtful of his patients' feelings. In two of our clinics, with these favorable conditions, the store workers have paid approximately $3.50 to $3.75 an hour for dental service.

A carefully prepared budget limiting the dental operations was worked out before the service was started. This budget limited the operations to "preventive" or minor dentistry and emergencies.

To care for major dental operations, patients were referred to private dentists of known professional standing or to a special pay clinic at the Harvard Dental School.

Experience shows that once the confidence of the store worker is gained, the store dentist can hold the patient till the mouth is put in order. Many store workers, however, do not follow instructions when referred to private dentists or to a clinic, even though in grave need of dental care. A careful followup system is therefore necessary to obtain results. If a charge is made for broken appointments, much trouble is avoided.

An individual record card with or without a diagram of the teeth is in common use. Dates of operations and work done, with time consumed and charges made, are recorded. A copy of this record of the condition of the mouth is a valuable addition to the medical record.

A monthly report sums up the work accomplished in the dental clinic and points the need, giving justification for money expended and serving as a basis for future plans.

Two stores employ dental hygienists for full time. Their work of cleaning teeth has steadily increased. Their educational value is appreciated and preventive dentistry grows more popular.

"Adequate dental facilities for a community cannot be built up on the basis of private dental practice," says Davis,[1] in his able report on community dental service. "The industrial dental clinic obviously fits into the scheme for community dental service by assisting in providing service for adults."

I have attempted to show that store dental clinics are not only an aid to public health, but through the education of store workers in good dentistry are an aid also to the capable private dentist.

Arrangements have been made with the manufacturer of a toothbrush with a bamboo handle, and good quality of bristles, of proper length, and with one of the floss silk manufacturers, who will supply pocket floss silk at actual cost so that the Oral Hygiene Commitee of Greater New York is now in a position to supply the brush and floss silk for 10 cents. To keep the cost down, it is necessary not to have any bookkeeping; therefore, checks must accompany all orders, made payable to Dr. Thaddeus P. Hyatt, 1 Madison Avenue, New York City.

1. Davis, M. M., Jr.: Community Dental Service, 1922, p. 37.

MY IDEA OF DENTISTRY IN 1950

By C. N. JOHNSON, Chicago, Illinois

MANY men have confidently predicted the end of the world at given dates. I have lived through several of those dates myself and the world still wags—showing that predictions are not always reliable. Therefore my predictions about dentistry in 1950 may be all amiss, but that doesn't dampen my ardor for making those predictions.

In 1950, I think I see less dread of dental operations than there is today: there is less dread today than there was a quarter of a century ago. This will be due not so much to the increased use of local anesthetics as to improved methods of operating, and to the earlier attention that will be given the teeth of children by their parents. The prevention of dental diseases will be more nearly an accomplished fact, not in all probability, because of anything spectacular or revolutionary in our discoveries, but because of a wider knowledge of the benefits of prevention, and a closer cooperation on the part of the public and the profession. Prevention, if it ever comes, must come though the efforts of the people more directly than through the profession. The only thing the profession can do is to point the way. Prevention will come through better modes of living, better sanitation, more intelligent regulation of diet, greater coordination of mind and body, better thinking. I have sometimes thought it *might* come through vaccination. But I have been laughed at for saying this, and that is one reason why I repeat it now—I like to make people laugh. Sometimes an apparent joke turns out to be the profoundest truth.

In 1950, the care of children's teeth will be considered even more important than it is today, because of the fact that it will be generally recognized that any disease that is the most prevalent of all human ailments must be reckoned with in its earliest stages if it is to be controlled or cured. To this end, in 1950, expectant mothers will be trained in the fundamentals of health habits as they relate to the building up of strong and vigorous offspring, and they will know more than they do today about the proper feeding of babies and young children for the maintenance of good health.

In short, as I have just intimated, the prevention of dental disease must be carried out in the home where, after all, every real reform finds its consummation. My plea to the people is that they maintain an open mind on questions tending to the prevention of diseases of all kinds. Disease is the most appalling extravagance of the age, the most criminal wastefulness. The cost of disease in this country alone runs annually into the billions—a sum vaster than you or I can comprehend—and much of it is preventable, even with our present knowledge.

The history of the world goes to show that in working any reform the

problem is not confined to gaining sufficient knowledge for the reform—the chief difficulty lies in inducing those for whom the reform is intended to take advantage of it. If the people of this nation today really want to live healthier, happier, more economical and altogether saner lives, they can do so. It is merely a matter of taking advantage of the knowledge at our present command, and, on the part of the people, in cooperating with our health authorities in all measures concerning their physical welfare. The American Dental Association is meeting in Louisville at this time for the purpose of learning better ways of preserving dental health, and its members will be only too glad to pass on to the people the knowledge thus obtained. All they ask is that the people accept and profit by it.

AMERICAN DENTAL HYGIENISTS' MEETING

The first biennial meeting of the American Dental Hygienists' Association, was called to order, September 21, at the Seelbach Hotel Louisville, Ky.

Interesting sessions were held and splendid reports were given from each association delegate present. Several state societies held exhibits and clinics at the invitation of the American Dental Association as part of the big health exhibit.

September 22, an informal luncheon was held with forty-eight present including as guests Drs. Alfred C. Fones; Harvey J. Burkhart; Thaddeus P. Hyatt and C. J. Hollister.

Forty-four hygienists were in attendance at the meetings during the four day session, representing the sixteen states licensing the dental hygienist.

Officers elected for the ensuing year are as follows: president, Edith Hardy, Rochester, N. Y.; president elect, Ethel Covington, Denver, Colo.; first vice president, Elma W. Platt, Sacramento, Calif.; second vice president, Harriett Putnam, Worcester, Mass.; third vice president, Helen Rosenthal, Bridgeport, Conn.; secretary, Leona Mitchell, Harrisburg, Penn.; treasurer, Mildred Gilsdorf, Chillicothe, Ohio.

It was voted to hold meetings annually, at the time and place of the meeting of the American Dental Association. Plans are now being formulated for the meeting to be held in Philadelphia, next year.

ADDITIONS TO THE BOOK SHELF

Anyone wishing to give a health talk may be interested in the following books, which will be loaned for a week:

"Effective Speaking," by Arthur Edward Phillips. Published by The Newton Company, Chicago.

"Health Speaker's Handbook," by Iago Galdston, M.D. Published by the National Tuberculosis Association, 370 Seventh Ave., New York City.

"Care of the Mouth and Teeth," by Joseph H. Kauffmann, D.D.S.; published by the Allied Book Co., 500 Fifth Avenue, New York City.

"Personal and Community Health," by Clair E. Turner; published by C. V. Mosby Co., St. Louis, Mo.

"Preventive Dentistry," by Alfred C. Fones, D.D.S.; published by Lea & Febiger, New York City.

"The Normal Diet," by W. D. Sansum, M.S., and M.D.; published by C. V. Mosby Co., St. Louis, Mo.

TEACHING HYGIENE TO CHILDREN

Health charts, plays, songs, drills, posters, stories, contests, essays, armies, honor rolls, houses, crowns, and even health clowns, make up the vast bulk of our child health literature and discussions. Daily, new material, new devices and new methods for teaching health to the child are making their appearance. For the most part, this phase of a child health program—health education—has been commendable. We are immeasurably indebted to those far-reaching agencies which have stimulated and are stimulating interest on the part of the teachers for health education. In fact, I am satisfied that it is to these teachers that we owe most for the widespread interest in our present child health programs. Let us have, then, even more methods, materials and devices for teaching health.—John Sundwall, in *Am. J. Pub. Health*, June, 1925.

RADIO TALK

The United States Health Service has recently released a radio talk on "Halitosis," which may be broadcast by giving proper credit. Copies may be obtained through the Department of Dental Health Education, American Dental Association, 58 East Washington St., Chicago.

FIELD NOTES*

Following is an abstract from a report of the first three years' work of the East Harlem Health Center (New York) Demonstration. This demonstration is sponsored by the American Red Cross, in cooperation with the New York City Health Department, which heads the twenty-four agencies in the project.

"As far back as February, 1921, at the request of the City Health Commissioner, the Red Cross Health Service Committee appropriated a sum of money to assist the Health Department in proving the value of dental hygiene clinics in public school buildings.

"The first dental hygiene unit was established in December, 1921. It was conducted by a trained dental hygienist who supervised the work of ten student hygienists from the Columbia School of Oral Hygiene, the Chapter furnishing portable dental chairs.

"The second and third years this service was extended to other schools through continued arrangement with the Columbia School of Oral Hygiene, a unit of eighteen students under supervision being assigned to two schools each year. There are ten public schools within the boundaries of the East Harlem district with a population from the district of 27,316 children (1920 census). During the period of the demonstration 14,736 children in six of these schools had oral hygiene treatment and received instruction as to the importance of dental hygiene.

"It is an interesting side light that, whereas the consent of local principals was given with some reluctance the first year, those in whose schools no dental hygiene had as yet been conducted applied for the service the last two years."

*The Department of Dental Health Education will be glad to receive items of news along the lines of education in dental or general health.

The Texas State Dental Society was recently invited by the Texas Medical Society to join in a health campaign. Part of the letter is as follows:

"I am officially extending to your body the invitation of the State Medical Association of Texas to appoint a special committee to study problems of teaching health and with authority to join with the organizations mentioned and indicated in an organized effort to improve health conditions in our schools and cooperate with similar national committees in such good work of this character as may be indicated and may seem wise.

"It is not possible to discuss here the various subjects to be studied by such joint committees. Suffice it to say that all phases of health both in the administration of our schools and in their curricula, will be proper subjects for discussion. It will naturally follow that plans will be developed for protecting the public health from this angle, in conjunction with the efforts of the American Medical Association and the National Educational Association, particularly, and our respective organizations brought into closer cooperation in these important matters."

Miss Evelyn Schmidt, Director of the Department of Dental Health Education of the American Dental Association, has completed a series of radio talks, which were broadcast from Station WQJ, Rainbo Gardens, Chicago. The subjects were "Airing Some Tooth Truths," "From What are Teeth Built," "The Sweet Tooth," "When Teeth Go to School" and "Toothfully Speaking."

The Bureau of Education, U. S. Department of the Interior, Washington, D. C., has recently published a pamphlet on "The Dental Hygienist." Copies were sent to superintendents of schools in cities having a population of 10,000 or over, to public libraries, heads of departments of education in colleges, educational periodicals and newspapers and principals of public normal schools; persons especially interested in health and physical education whose names are on the Bureau's mailing list, and to all the schools for dentistry in their educational directory. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C. Price 5 cents.

The Journal of the American Dental Association

58 East Washington Street, Chicago, Illinois.

Please send in promptly notice of change of address, giving both old and new. Important information regarding subscription price, etc., will be found in the advertising pages.

Editorial

THE BUCKLEY-PRICE DEBATE

As will be noted in another department, we are publishing in the present issue the Buckley-Price debate. While it is not customary to make editorial comment on matter appearing elsewhere in THE JOURNAL, the transcendent importance of this question of pulpless teeth and its prominence in the professional and public mind at this time makes it imperative that the widest consideration be given it from every possible source.

First, we would pay a tribute to the masterly way in which each debater presented his subject. It was, as President Goslee said, a momentous occasion, with an estimated audience of fifteen hundred listening tensely to the arguments pro and con; and the evident seriousness with which each speaker approached his subject showed how important the issue appeared to him.

It would be futile at this time to attempt to refer in any detail to the various points raised by the debaters, but out of the haze of the entire discussion—and there was much haze connected with it—there is one concrete consideration which has a practical bearing on the general question of pulpless teeth, which it would seem appropriate to emphasize. It was the pivotal point made repeatedly by Dr. Price to the effect that a pulpless tooth cannot be sterilized in the mouth. In this connection, he said: "It is practically a physical impossibility, if not completely so, to sterilize infected cementum by treating through the dentin. It is like trying to sterilize infection in the label of a bottle by putting disinfectants in the bottle."

His argument is based upon the assumption that no disinfectant can ever pass the barrier of the dentinocemental junction, that the line where these two structures join is impenetrable. This he emphasizes in the strongest possible terms, and there is no misunderstanding his position. He even goes so far as to prove this by a study of the laying down of these tissues in the development of the tooth. He says: "The two formative organs, building toward each other, throw down at first a common continuous wall, which is in effect like a bottle or flask, the opening to which is at the root apex." He further states: "Silver nitrate, for example, placed in the interior of a tooth stains the dentin, but does not stain the cementum. Similarly, silver nitrate placed on the exterior of a tooth stains the cementum, but does not stain the dentin."

Nothing can be more positive than this, and yet, in making these assertions, Dr. Price has unconsciously been "hoist on his own petard." It is a poor rule that will not work both ways, and if it is impossible for the agents of *disinfection* to pass this barrier, it is equally impossible for the agents of *infection* to pass. Consequently, *the only thing necessary to make every pulpless tooth perfectly safe to the host is to seal the apical foramen.* There is no escaping this contention—if Dr. Price is right.

Mayhap, Dr. Price *is* right, and mayhap that accounts for the well-known clinical fact that there are countless thousands of pulpless teeth being retained in the mouths of people today to their great comfort and advantage, and with not the slightest injury to their physical well-being. There is no intent, at this time, to take sides in the recent debate, but merely to refer to this point, which was so strongly emphasized by Dr. Price, and to call attention to its practical application.

The consideration of the subject of pulpless teeth is not ended. It is to be followed up by other organizations, notably by the Chicago Dental Society at its December meeting, and also at its midwinter clinic in January, 1926. We are also creditably informed that it is to be one of the topics for discussion at the meeting of the Dental Society of the State of New York next

May, and doubtless it will be taken up by various other organizations.

All of this is well. Out of much deliberation there must come a clearer idea on this mooted question—a question which today is leading to greater confusion and more uncertainty than any other before the dental profession. And be it said, in this connection, that much of the confusion is caused by clouding the issue with too many irrelevant statistics which have no practical bearing on the main issue, and which take no account of the actual happenings in the mouths of actual people. The farther we get away from concrete clinical experience, and the more we browse in the herbage—or verbiage—of speculative and spectacular deductions, the more we are likely to confuse the profession and the people, and the farther we shall wander from common sense and the truth. Let us above all things keep our feet firmly on the ground, and study this question calmly and judiciously instead of employing so much sensationalism and extravagance in its discussion. We may thereby be less impressive, but we shall be nearer the truth, and in the end we shall do more good.

OUR GENERAL SECRETARY

At various times in the past, there have appeared in the pages of THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION the portraits of officers of the organization, but the picture of one man has been omitted except where it appeared in a group. In this issue, we are presenting as our frontispiece and without his knowledge, the picture of our General Secretary. We feel sure that our readers in all parts of the world will be glad to see a portrait of the man who has been so intimately associated with the development of the Association for many years. Dr. King is probably more familiar with the various activities of our organization than any other man living. He has been so close to every movement which has been made for its advancement, and has watched its growth with so vital an interest that it has become the very warp and woof of his professional life. Each succeed-

ing president has gone to him for inspiration and suggestion, and has never gone in vain.

He knows the essentials of dental society organization as do few men in the profession, and particularly as they apply to our own parent body. He was made General Secretary of the American Dental Association in 1913, and has assiduously studied its welfare ever since. He at once began the publication of a bulletin, and this has gradually developed under his able guidance into the splendid journal of the present day. At Louisville, in September, 1925, the Board of Trustees, recognizing that the duties of his double office had become too burdensome, arranged for a division of service, and appointed a new editor, retaining Dr. King as Business Manager.

Outside the Association, he has been given many responsible positions and has received numerous honors. Graduating from the Northwestern University Dental School in 1897, he began practice in Huntington, Indiana, near the place of his birth, and, in 1907, he was elected secretary of the Indiana State Dental Association, which office he held till he was made President in 1914. He was, respectively, secretary and president of the Northern Indiana Dental Society, was elected a delegate to the Sixth International Dental Congress in London in 1914, was appointed by the Surgeon General as preliminary dental examiner of applicants for commissions in the Dental Reserve Corps of the United States Army in 1917, was a member of the Commission on Dentistry of the General Medical Board, Council of National Defense, and Chairman of the Committee on Publicity. He was elected Honorary Member of the Association of Military Dental Surgeons of the United States in 1917, and was a member of the Advisory Board of the Preparedness League of American Dentists the same year. He was appointed examiner for dentists of conscription age, Class 1 A, 1918. He was one of five dentists who conceived and planned the American College of Dentists, and drew up the first draft of its constitution, in 1920. He has been Trustee of the Research Institute of the American Dental Association. He is an honorary member of the Ohio and Georgia

State Dental societies, and an associate member of the Mississippi State Dental Society. He was elected by the American Dental Association a delegate to the International Dental Federation, and has attended the meetings of 1924 and 1925 in Europe. He is a member of the Organization Committee of Thirty for the Seventh International Dental Congress to be held in 1926, and was made Secretary General of the Congress. He is an honorary member of the Sociedad Odontologica Cubana, and, on November 28, 1923, he was given a degree and presented with a gold medal by this body. He is a life member of Delta Sigma Delta Fraternity, and a member of Beta Theta Pi (Indiana University).

He has not confined his activities solely to dental matters, but has been interested in other affairs, such as church work, and as a member of the Association of Commerce of Chicago. He is a member of the board of governors of the Medical and Dental Arts Club of Chicago, and is active in all forward movements having for their object the upbuilding of the profession and the welfare of society.

On October 26, 1925, his own home organization, the Northern Indiana Dental Society, tendered him a banquet at Huntington, Indiana, at which were assembled a large body of men and women made up not only of members of the Society but also of delegations from Indianapolis, Chicago, and Michigan. It was a most delightful occasion, expressive of the high regard in which Dr. King is held by those with whom he has labored so many years. We are very sure our members in all sections of the country will be pleased to see the picture of our General Secretary, and to read this brief recital of his achievements, and of some of the honors that have come to him.

THE CHRISTMAS SEALS

Once more the Yuletide season approaches and brings to us the memory of other Yuletides—the hearts made glad, the eyes brightened, the hearth fires glowing, the peals of happy laughter, and the hum of old familiar voices. The passing years

would be barren and prosaic without the annual advent of Christmas. We are all brought back to the blessed days of childhood—the hopes, the aspirations, the visions, the dreams, and the dear illusions.

Out on the heaving sea of life there stands this brilliant light warning us of the sordid rocks of selfishness, and beckoning us to the harbor of happiness and good will. It is the one time in the twelve months when meanness is relegated to the rear, and when wholesouled and spontaneous generosity and charity waft us to the heights where the atmosphere is rarer and the motives of men are purer.

Let us welcome Christmas as our great annual benediction—our chastening, our consecration to new ideals, our incentive to better living. Let us enter heartily into the spirit of the occasion, and reach out to grasp the hand of our fellowman. Above all, let us expand our sympathies to take in the needy who are less favored than we. Let us bring a smile for once into the homes of the unfortunate and the bereft.

For the dentists of this entire country there is at this time a wonderful opportunity to record their goodwill in a tangible and most appropriate way. And the cost is so small that it will not be felt by anyone. Through the medium of the Christmas seals which are sent to every member of the American Dental Association, this annual expression of fellowship and comradery is made manifest from one end of the land to the other. The fund heretofore raised through this means has now reached such proportions that it can soon be made to function and the income used for the relief of our needy members. At the Louisville meeting, our efficient Relief Commission, which has been functioning less than a year, reported that, if carefully conserved, the endowment fund might soon be adequate to care for all the legitimate cases coming under its ministration. There was even an intimation in the House of Delegates that it might be well to discontinue sending the seals, but there at once developed a spontaneous expression of opinion so strongly in favor of it that it was decided to continue them for at least a period of five years. It was argued that there

is a great sentimental advantage in this Yuletide outpouring of heartiness and helpfulness toward our needy brothers in the Association. It brings a glow to a man's heart when he contributes his mite voluntarily toward the relief of suffering of any kind, and particularly when he knows, as he must in this instance, that every dollar is used with the most scrupulous care for the concrete object of beneficence. The painstaking and business-like way in which our Relief Commission has administered this activity has inspired the utmost confidence on the part of everyone familiar with its work, and, as a consequence, there are many men who will contribute this year to the Christmas seals who have never contributed before. Up to this year, when the appeal for funds has been made, the impulse which inspired our members to send their money was the faith that something ultimately would be done; but, on this occasion, the incentive is doubly great because of the tangible fact that something is already being done. Now that actual relief to needy members is in full operation, there is surely not a man in the Association who will hesitate to send his dollar the moment the seals are received.

Let us make it one hundred per cent this year, and thus go over the top and ensure the happiness of everyone.

"SELLING" DENTISTRY

It is an impetus to the all too prevalent tendency to commercialism in our profession to refer to the bestowal of our services as "selling" dentistry.

The expression "sold" on a set of teeth or a filling or a bridge, as the case may be, is the limit of bad taste and should not be tolerated in the office of a cultured and accomplished member of our profession.

Very few of our professional brethren would say "trade is good" in referring to a satisfactory condition of their practices, nor would they call their patients "customers"; yet all these things savor of selling.

Unfortunately, modern salesmanship too often implies an

ability and inclination to sell a person something they do not need or want. This is all obnoxious to the real professional spirit and should be discouraged to the limit.

There are plenty of ways of offering our services other than "selling" them or making studied "selling talks." This habit of approaching a patient as to his dental needs is a recent innovation and should be stopped before it does any more injury to the dignity of the profession.

CHARLES CHANNING ALLEN.

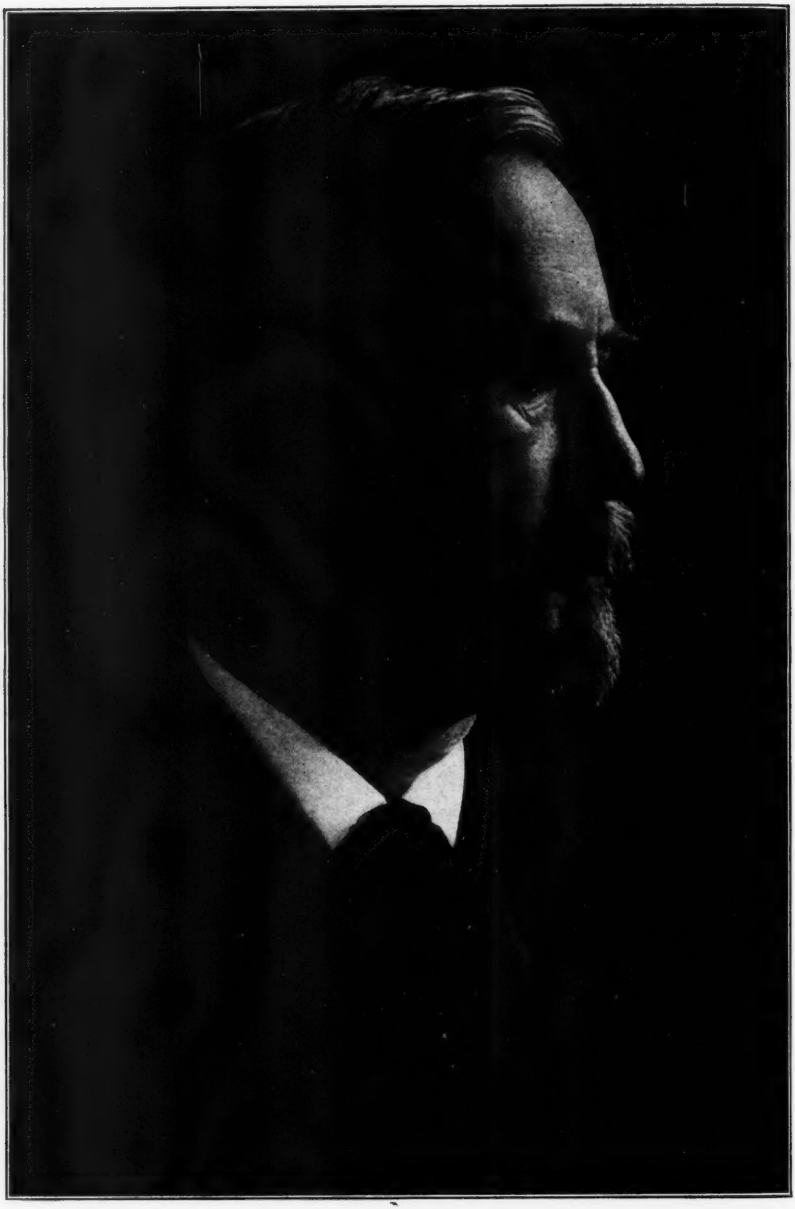
WILLIAM CARR, M.D., D.D.S., A.M.

William Carr, New York City, past president of the American Dental Association (1907-1908) died, Oct. 15, 1925, at his summer home at Centre Moriches, N. Y.

Dr. Carr graduated from Bellevue Hospital Medical School with the degree of Doctor of Medicine and later, in 1872, from the New York College of Dentistry. He was given the degree of A.M. *causa honoris* by Rutgers College. For years, Dr. Carr was one of the censors charged with licensing dental practitioners, in the Dental Society of the State of New York, and also chairman of the law committee. The enactment of many of the laws regulating dental practice was due to his efforts. Among these were the laws requiring adequate preliminary education and a four-year course of study in an approved dental college as a prerequisite to conferment of the D.D.S. degree and a state license to practice dentistry.

Dr. Carr gave up a lucrative practice to accept the deanship of the College of Dental and Oral Surgery of New York, for the establishment of which he was in large measure responsible, in that he revived the New York College of Dental and Oral Surgery, changing the name and consolidating it with the New York Dental School. The funds for constructing and equipping the dental school buildings were raised by Dr. Carr. His ambition to unite the college with one of the larger universities was realized in 1923, when consolidation was effected with Columbia University; and in this accomplishment, Dr. Carr achieved a purpose long and earnestly desired, near the close of a full and successful life.

Dr. Carr's passing is mourned by numberless friends and his friendships were world wide.



WILLIAM CARR, M.D., D.D.S., A.M. (*causa honoris*), New York City,
President of the American Dental Association 1907-1908.

Medical and Dental News

Connecticut

Dr. Printz Addresses New Haven Dental Society: Dr. Herman Printz of the Thomas Evans Dental School of the University of Pennsylvania addressed the New Haven Dental Society, October 16. There was a large attendance from all over New England.

Dr. Howe Lectures in Hartford: At a meeting of the Hartford Dental Society, October 12, Dr. Percy R. Howe of Boston gave an illustrated lecture on "Striking Effects of Deficient Diets," which was largely attended by members of the society and by many members of the medical profession.

Dr. Briggs Addresses Hartford Dental Society: At the regular monthly meeting of the Hartford Dental Society, Nov. 9, Dr. Walter E. Briggs of Attleboro, Mass., gave an illustrated talk and clinic on inlay bridge work. Forty members were in attendance.

Illinois

Tablet to Dr. Black Unveiled: At the Jacksonville Centennial, October 11, a tablet to Dr. Green Vardiman Black was unveiled.

Dentists of Four Counties Hold Clinic: Dentists from Adams, Hancock, McDonough and Fulton counties held a clinic at Quincy, October 15-16. The following officers were elected for the ensuing year: Adams-Hancock Society: president, J. F. Elliott, Clayton; vice president, E. F. Koetters, Quincy; secretary-treasurer, J. F. Keeney, Quincy; McDonough-Fulton Society: president, James A. Barclay, Macomb; vice president, H. H. Hamman, Rushville; secretary-treasurer, C. P. Jackson, Macomb; librarian, E. D. Herring, Bushnell. Drs. S. D. Tylman and Polk E. Akers of Chicago presented papers and clinics before the joint meetings.

Aurora Study Club Organized: The Aurora Dental Study Club was organized, October 8, with the following officers: president, Dr. A. L. Roberts; secretary, Dr. Charles R. Deindorfer; treasurer, Dr. George Thompson. The club proposes to (1) promote organized study of dental conditions and to cooperate with charitable organizations in the care of the teeth of needy children; (2) supervise dental examinations of school children, and (3) provide an organization of Aurora dentists for study of advanced technic. A dental clinic is to be established at the Juvenile Home, with the intention of expanding the work as soon as possible to include all indigent children of the community.

Suggested Legislation Against Morons: A resolution passed recently by the Northern Illinois Dental Association empowers a committee "to memorialize the Illinois legislature to enact a measure making certain provisions which the committee shall point out as being effective for the prevention of crime other than the segregation of the so-called morons." The resolution was passed after an address advocating such action by J. Stanley Brown, president of the Northern Illinois Teachers' College.

Teeth of School Children 85 Per Cent Defective: According to figures obtained by a supervisor of oral hygiene for the board of education, Chicago, an average of 85 per cent of elementary school pupils have tooth defects, the percentage running from 70 to 95. In schools in which oral hygiene is being taught, the increase of 100 per cent perfect mouths has been marked. The following figures are given in the report: Audobon schools increased from 11.2 to 51 per cent; Bancroft, from 9 to 40.5; Drummond, from 9 to 50; Morris, from 17.7 to 57.3; Pulaski, from 7 to 40; Schneider from 12.8 to 52.3; Hawthorne, from 14 to 59.3; Prescott, from 10 to 50; Manierre, from 12 to 50.5, and Ogden, from 15 to 51.

Northern Illinois Dental Society Meets: The Northern Illinois Dental Society held their thirty-eighth annual meeting, October 15, at Dixon. After a morning of essays and clinics and installation of officers, lunch was served at the Dixon Country Club and the afternoon was spent on the links.

Medical Arts Club Reorganizes: The Medical Arts Club of Chicago reorganized recently with the following officers and directors: president, John S. Nagel, M.D.; vice presidents, John H. Cadmus, D.D.S., and Robert H. Hayes, M.D.; secretary, Frederick R. Green, M.D., and treasurer, William Allen Pusey, M.D.; directors: John S. Nagel, M.D., Robert H. Hayes, M.D., Hugh N. MacKechnie, M.D., J. H. Walsh, M.D., Charles E. Humiston, M.D., Arthur D. Black, M.D., D.D.S., A. A. Goldsmith, M.D., John H. Cadmus, D.D.S., Harry B. Pinney, D.D.S., M. M. Printz, D.D.S., Otto U. King, D.D.S., William Allen Pusey, M.D., Frederick R. Green, M.D., and C. N. Johnson, D.D.S. At a meeting held October 30, it was voted to change the name of the club to Medical and Dental Arts Club of Chicago. Plans for a building include an assembly hall seating from 700 to 800 for the regular meetings of the Chicago Medical and Chicago Dental societies and for other professional meetings and conventions, rooms for the various local special societies, headquarters for the Chicago Medical and Chicago Dental societies, the Illinois State Medical and Dental societies, the American Dental Association and others; club rooms for the convenience of the members; and bedrooms for resident and out of town members and guests. The remainder of the building, including 75 per cent of the total available space, is to be rented as stores, offices and sales rooms to firms doing business with physicians and dentists.

Dr. Hatton Addresses Ophthalmological Society: At a meeting of the Chicago Ophthalmological Society, November 16, Dr. E. H. Hatton, professor of pathology, Northwestern University Dental School, and research investigator for the American Dental Society, gave an address on "The Dental Factor in the Etiology and Treatment of Iritis."

Indiana

Joint Meeting of Dentists and Physicians: The Clay County Medical and Dental societies held a joint meeting in Brazil, October 15, at which papers of interest to members of the two professions were read. Roentgenograms of recent cases were shown by physicians connected with Community Hospital, where the meeting was held.

Northern Indiana Dental Society Meets: The thirty-sixth annual meeting of the Northern Indiana Dental Society was held in Huntington, October 26-27, in joint session with the Wabash Valley Dental Society. Papers were read by Drs. Sherman Davis, Bloomington, U. G. Rickert, Ann Arbor, Mich., A. Alfred Nelson, Detroit, Mich., and Miss Evelyn C. Schmidt, Chicago, Ill. Monday evening, October 26, Dr. Otto U. King, Chicago, Ill., General Secretary of the American Dental Association and, for many years after its founding, secretary of the Northern Indiana Dental Society, was honored at a banquet at which 140 guests were present.

Louisiana

Dr. Knapp Honored: The degree of Doctor of Philosophy was conferred on Dr. J. Rollo Knapp, New Orleans, La., November 20, by the Christian Brothers College of Memphis, Tenn. At the same time the governor of the state of Louisiana, on behalf of the Alumni association of the Christian Brothers' Students of the South, presented Dr. Knapp with a gold traveling card reading "For over fifty years in the practice of the Profession of Dentistry and in our service as President, the Alumni Association of the Christian Brothers' Students of the South presents this gold traveling card to J. Rollo Knapp, Ph.D., M.A., B.A., D.D.S., E.H.D.P."

New England

Dr. Rice President of New England Dental Society: The New England Dental Society has elected Dr. William Rice, Boston, president of Tufts Dental School, as president of the society for 1925-1926. Dr. A. A. Hunt, of Hartford, was reelected secretary.

New York

Dr. Jackson Dean of New York University College of Dentistry: Dr. Holmes C. Jackson, professor of physiology in the New York University and Bellevue Hospital Medical College has been named dean of the New York University College of Dentistry. Dr. Jackson has been a member of the faculty of New York University and Bellevue Hospital Medical School since 1901, except for four years when he was on the staff of Albany Medical College. When the New York College of Dentistry became part of New

York University last spring, Dr. Jackson was appointed assistant dean of the medical college, to be in charge of dental instruction given in the medical school and to serve as liason officer between the medical and dental colleges.

FOREIGN

New Dental Journal: With the October issue, the *Indian Dental Journal*, "A Quarterly Journal Devoted to the Advancement of Knowledge Pertaining to Dental Science," makes its appearance. The original contributions include a foreword by C. N. Johnson, and articles by Percy R. Howe, M. K. Patel and A. K. Dutt. Other departments include announcements, dental legislation, editorial, mouth hygiene, book reviews, notes and miscellanea. The journal is published in Calcutta, and R. Ahmed, D.D.S., is the editor.

Women Dentists in France: The number of practicing women dentists in France exceeds several hundred. All hold degrees of the French Medical Faculty and the majority hold a degree of the Faculty of Paris. According to an annual report recently published in Paris, their number is 126. Several women dental surgeons belong to the teaching staff of the dental colleges, and one holds the degree of D.D.S. from the University of Buffalo College of Dentistry.

A Medical Degree for Dentists: At a recent meeting of the Societé de stomatologie, M. Paul Boudina questioned whether dentists who do not hold an M.D. degree should be allowed to practice vaccinotherapy, and whether or not the degree of dental surgeon (*chirurgien-dentiste*) should be abolished and an M.D. degree be demanded of all practitioners of dentistry. Since the present law allows a physician to practice dentistry in all its branches and have recourse to all the resources of therapeutics, a simple dentist's range of action should be limited and he should not be authorized to administer special forms of medication, including the use of vaccines, serums and toxic substances. The ministerial decree of July, 1917, which limits the use of toxic substances by *chirurgiens-dentistes*, established this principle very plainly. Since a dentist may treat cases requiring vaccines or toxic drugs (which he has not the authority to administer), it would seem desirable that his field be extended. This cannot be legally accomplished except by the acquisition of the M.D. degree.—*London Letter, J.A.M.A.*, Oct. 24, 1925.

Explosion in Mouth During Operation: A fatal explosion of which the cause remains obscure, has taken place in a boy's mouth during an operation. A boy, aged 16, collided with a motor car while cycling. He was taken to the hospital, where his jaw was found to be fractured. In the course of an operation on the jaw, it was found necessary to keep the teeth dry by means of warm air supplied through a dental syringe. Ether and oxygen were the anesthetics used. On the third application of the warm air, an explosion occurred at the back of the boy's mouth. Acute hemorrhage followed, and he died in ten minutes. At the inquest Mr. Percival Cole, a surgeon and an authority on the injuries of the jaw, who performed the operation, said that after the explosion the apparatus used burst into flames. During the war, 1,600 cases of this sort passed through his hands, and what was done in this case was merely routine work. Ether is very inflammable, but there was no naked flame near. In his opinion, the explosion was due to a mixture of vapors. The teeth were smeared with alcohol and had afterward to be made perfectly dry, otherwise the dental cement would not adhere. The anesthetist gave evidence that in 1,200 cases he had never encountered anything similar to what happened in this case. The jury returned a verdict that death was due to accident.—*London Letter, J.A.M.A.*, Nov. 7, 1925.

Medical Treatment of School Children: The board of education has issued new special regulations made under the education act. Each child in a public elementary school must be medically examined on admission, and on attaining the age of 8 and of 12 years. Local authorities must make arrangements for (a) following up cases of defect found in the course of medical inspection, (b) the detection and prevention of uncleanliness, and (c) the medical treatment of defects of eyes and teeth, minor ailments and enlarged tonsils and adenoids. This means the setting up of dental, ophthalmologic and minor surgical clinics. The local authorities are now ordered to provide for the medical inspection of persons under 18 attending secondary schools, pupil teacher centers, preparatory classes and

junior technical schools. They may also make such arrangements as may be sanctioned by the board for attending to the health and physical conditions of the pupils attending secondary schools and other specified institutions. In the case of nursery schools, it is ordered that adequate arrangements must be made for attending to the health, nourishment and physical welfare of the children.—*London Letter, J.A.M.A.*, Oct. 10, 1925.

General

Dr. Martin Heads Gorgas Institute: Dr. Franklin Martin, of Chicago, was recently elected to the newly created office of active president of the Gorgas Memorial Institute of Tropical and Preventive Medicine.

Medical Defense: Since the Ohio State Medical Association placed its medical defense plan in operation in 1916, there have been 122 suits and ninety threats filed with the committee, up to August 20, and the cost of the plan has been $12,947.68. A report of the Medical Defense Council, July 1, showed that there were then twelve suits pending. Defense is not granted to a member of the state association who does not forward his application blank to its office within ten days after the service of summons, nor to physicians who do not keep on file roentgenograms in fracture cases when alleged malpractice arises for such a case, or for a physician who has brought a "cross complaint" by suing to collect a bill within one year of the termination of his services. In a summary of the malpractice situation, the *Ohio State Medical Journal* assigns the increase in malpractice suits to such causes as careless remarks of other physicians, economic need (more suits are filed by the indigent), ambulance chasing lawyers, professional jealousy and, greatest of all, the uncontested settlement of nuisance suits. The number of malpractice suits and threats in Ohio has remained about the same the last five years owing, it is said, chiefly to the plan of fighting to the finish and to the fact that physicians have grown more careful in their comments.—*J.A.M.A.*

Deaths

Meyer, Louis A., Oconomowoc, Wis.; Chicago College of Dental Surgery, 1889; died, November 7 of heart disease; aged 57.

Moran, Joseph A., Hartford, Conn.; Baltimore College of Dental Surgery, 1909; died November 4, in Boston, Mass., following an operation for throat trouble.

Whitefield, G. W., Evanston, Ill.; Chicago College of Dental Surgery, 1886; died recently, after a long illness; aged 70. Dr. Whitefield was at one time an instructor in Northwestern University Dental School.

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Infectious Granulomas from Abscessed Teeth: Apical abscesses of long standing occasionally break through to the surface of the skin and produce lesions which may be confused with cancer. (Ernest M. Daland, *Boston M. & S. J.*, Aug. 6, 1925.) The lesion shows an inflammatory induration, a central ulceration and has a tendency to become crusted over. The discharge from the central ulceration may be so slight that it is not noticed. The lesion may be so far distant from the teeth that the possibility of its relation to the teeth is not considered. However, such lesions do not respond to the usual dosage of radiation—a point to be kept in mind in the diagnosis of doubtful cases. Three of four cases, reported in detail, were considered cases of skin cancer and were accepted as such by a number of physicians. They had certain features in common, and might have been correctly diagnosed earlier. The third case at one time did have a basal cell carcinoma, but this was removed surgically and what was taken for recurrence was probably an infectious granuloma. All four infections were connected with abscessed teeth and were cured by extraction of the teeth.

Effect of Fluorin on Teeth: A review of the literature showed that fluorin has been found in all the tissues of the body, its highest incidence being in the teeth (about 0.3 per cent) and in the bones (about 0.2 per cent). When sodium fluorid has been fed to an animal, an equivalent amount was excreted in the urine and feces. The authors have investigated the effect of the ingestion of fluorid on the development and health of the teeth. Two groups of about fifteen rats each were used. Each group received the same ration satisfactory for growth, except that to the diet of one group was added 0.02 per cent sodium fluorid. The control animals developed essentially perfect teeth, while those receiving the fluorin showed marked changes in dental development. There were changes in the color and polish of the teeth. The mandibular incisors showed extreme friability which resulted in erosion. The maxillary incisors showed marked overgrowth with curvature probably due to failure of occlusion of incisors. Thus a small excess of fluorid over that normally in the diet caused definite retrograde action on the teeth. The overingestion of certain elements may have as distinct an influence on bone or teeth structure as a deficiency in the diet.—McCollum, Simmonds and Backer, in *J. Biol. Chem.*, abstr. *Am. J. Dis. Child.*

Education in Roentgenology: Preston M. Hickey in (*J.A.M.A.*, Aug. 22, 1925) is of the opinion that roentgenology as a modern specialty is inadequately taught in a large percentage of the medical colleges in the United States. Roentgenology should be recognized as a separate department in all standard medical schools and should have a director of professional rank. The teaching of roentgenology in our medical colleges should be carefully correlated with the other branches, so that the students would receive proportionate and adequate instruction in this specialty. The Class A hospital should assist in the teaching of roentgenology by affording its interns the opportunity to become acquainted with the every day applications of its principles. The training of the specialist in roentgenology should be one of the functions of a Class A hospital.

Danger of Caries During Orthodontic Treatment: There is no reason why it should require years to complete an orthodontic operation, if we orthodontists make the most of the opportunities available for cell growth and development. On the other hand, there is much to be gained by reducing the period of treatment. One of the greatest problems confronting us is the prevention of dental caries while our appliances are in the mouth. Admitting that the carefulness and skillfulness of the operator in the fitting and placing of the mechanism is very impor-

tant in this issue, yet the home care of the oral cavity by the patient is preeminently our salvation, or defeat. Therefore, the more quickly we can rid our patients of the handicap of appliances in their fight against tooth disintegration, the more chance there is of success. When orthodontic treatment is prolonged from six to ten years, it is only in the most immune mouths that permanent tooth injury, to a greater or less extent, is not found. Orthodontic operators who are so inefficient as to prolong treatment over such a long period of time are also apt to be very careless and hasty when seeing their patients. They fail to realize the necessity of recementing bands at fairly frequent intervals, a procedure that is essential in certain mouths to avoid enamel destruction; they are apt to allow ligatures and springs to impinge upon the soft structures and injure the peridental membrane; or they permit the appliances to rest upon unprotected teeth, until damage is apparent. Furthermore, the wearing of appliances for such long periods certainly adds some load to the child's burden in the way of physical or nervous strain.—F. A. Gough, in *Dent. Items. Int.*

Restorations: When a tooth has been lost in whole or in part, it is desirable that it be restored promptly before any further damage is done and in order to prevent still more impairment of function of the remaining teeth as well as lateral drifting and elongation. To bring about a satisfactory restoration it is essential that the dentist have a thorough conception of anatomical tooth form and that he apply this knowledge. Good judgment, of course, should be exercised. The existing conditions in the mouth should be noted and the operator governed accordingly. It is good practice in restoring a tooth to note the corresponding tooth on the opposite side of the jaw unless it also has been destroyed or mutilated. It would be ridiculous to carve cusps such as would be found in the tooth of a child of twelve for an adult of sixty whose cusps show considerable wear. A good guide for locating marginal ridges may be obtained by marking with a soft pencil the tooth just mesial or distal, or both, to the one being operated upon, which will reduce the tendency to overocclude. The filling should be carefully checked for any lateral or occlusal strain, and the patient should not be dismissed until he is sure that a normal occlusal relation has been established with the opposing teeth. Too frequently patients are dismissed while still conscious of pressure and told, "Oh, that'll wear down all right after you have used it awhile." But it does not always do so. Gold is malleable and will flow under occlusal stress. The strain will continue and many times an irritation is produced which may cause pulpitis. Usually pericementoclasia is the result, often with deep pocket formation. Therefore, a restoration should restore the original anatomical form as nearly as possible, and the occlusion with the opposing teeth, as well as the mesio-distal relation with the adjoining teeth, should be maintained. They should be mechanically efficient not only for mastication but in the protection of the periodontal tissues.—Max Giesecke, in *Dent. Digest.*

Health of the Working Child: A study was made of children under 16 years of age who had not, therefore, an extensive industrial history and could not receive working papers before their fourteenth birthday. Only children who had worked for at least six months were included. Those assisting in home housework were excluded. An equal number of boys and girls comprising 412 children were covered. It was found among other things that boys had the active jobs and girls the sedentary jobs. One-fourth of the children had wholly inadequate chairs. Five per cent handled weights exceeding 20 pounds. Nearly one-fifth worked in noisy surroundings. Heavy vibrations of machinery and rush of work exposed some to serious nervous strain. Only one child was found working on a dangerous operation, but 11 per cent had received some injury during work. Twenty-three were employed more than forty-eight hours (contrary to law). Over one-third had a lunch period of less than one hour. Lighting was good in the majority of places, but wholly inadequate in one-third. Two out of three worked in well ventilated plants. Visual defects were found in about one-fifth, of which only one-seventh were adequately corrected with glasses. Dental defects were found among one-third and enlarged tonsils among one-fourth. Thyroid enlargements were found in 5 per cent of the girls but not in any of the boys. Heart affections were found in 4 per cent, and some lung abnormality in 3 per cent. Overweight was more common than underweight. Puberty had not been reached in twenty-six of

the boys and nineteen of the girls. Endocrine deficiency was found in 9 per cent. Only 45 per cent were considered to have normal postures; 13 per cent showed some degree of scoliosis and almost one-fourth showed indications of flat foot. Three-fourths of the children had two or more defects.—*Spec. Bull. New York Dept. Labor*, abstr. *Am. J. Pub. Health*, September, 1925.

The Simpler Life: We have been too successful for our own good. Our ability to acquire has outrun our capacity for self-denial. Financial success has not been paralleled by moderation in eating and voluntary bodily discipline of exercise solely for health's sake. Shall the health officer and the family doctor have to warn against luxury, self indulgence and ease of circumstance among our city people to prevent diabetes, as they have fought valiantly for a sufficiency of food, rest and recreation as essentials in the control of tuberculosis? Here in the United States we are facing many a test of character in the midst of our amazing prosperity, and among them appears to be the question of our power of inhibition. Can we eat as little as we need, or force ourselves to exercise according to our appetite for foods? While accepting thanks for feeding the hungry of many lands, shall we lose our sense of proportion in the presence of abundance on our own tables? More use of shoe leather and less of balloon tires, more toting of our own luggage and less work for the "red-caps," more players on the ball field and fewer spectators are needed. Our bodies were given to us for use and at our peril we spare the muscles their work of expenditure and overload our functions of assimilation.—*Nation's Health.*

The Educated Physician: The assumption that a particular category of studies furnishes the key to produce a "humanized" being, and that the much vaunted "cultural" influences are derived from a particular group of collegiate studies, usually conceived to be non-scientific in character, appears to be warranted only by unestablished opinion. Billroth once remarked that culture is always an aristocratic thing. The physician, the school teacher, the lawyer, the clergyman, should be the best men of their village, of their city, of the circles in which they move. In order to be so, they must have the superpower that comes with knowledge and skill, and this is acquired only through the hard work of study, and even more through the cultivation of the inner urge to study. But in final analysis it is something more than the subject matter learned that characterizes the truly educated man. A person may have acquired from books a vast amount of medical knowledge, he may even have memorized from books the technic of its application; such a person has much knowledge of medicine, and yet with it all he is no physician. And similarly, specific courses do not determine the potential character of an education. Huxley had a better conception when he wrote: "That man, I think, has had a liberal education, who has been so trained in youth that his body is the ready servant of his will, and does with ease and pleasure all the work that, as a mechanism, it is capable of; whose intellect is a clear, cold logic engine, with all its parts of equal strength, and in smooth working order; ready, like a steam engine, to be turned to any kind of work, and spin the gossamers as well as forge the anchors of the mind; whose mind is stored with a knowledge of the great and fundamental truths of Nature and of the laws of her operations; one who, no stunted ascetic, is full of life and fire, but whose passions are trained to come to heel by a vigorous will, the servant of a tender conscience; who has learned to love all beauty, whether of Nature or of art, to hate all vileness, and to respect others as himself."—*J.A.M.A.*

Orthodontics and School Dentistry: Orthodontic treatment of school children cannot be considered only from the point of view of the teeth and jaws. There is also the question of the number of visits and the cost to the parent; the desirability of interfering as little as possible with the education of the child, and also the home conditions of the child, with their bearing on the possibility of maintaining a good standard of oral cleanliness without which orthodontic appliances may be hygienically harmful even though mechanically efficient. For these reasons a simple and short treatment which achieves a good functional result, though possibly not aesthetically or anatomically perfect, might be better than a more prolonged treatment which gave a more theoretically perfect result. One might indeed go further, and say that under whatever conditions orthodontics is practised, the same principles should hold good. But behind this question of orthodontic treatment lies the larger question of or-

thodontic training. If there is a possibility that within the next decade orthodontic treatment of school children will become a definite part of school dentistry, then there must be an improvement in the standard of orthodontic training, for, to speak candidly, at present it is not good enough. The newly qualified practitioners from whom the school dentists are chiefly drawn, are not usually sufficiently equipped to carry out orthodontic treatment efficiently. The best hope for the establishment of orthodontics in school dentistry lies in its gradual introduction as an extension of the existing service, with such modifications as are necessary in the way of providing facilities for the construction of appliances. Later on, orthodontic officers may be appointed, but in the beginning the existing staff would have to be called upon to do this work. It is time that the dental school orthodontic service paid for out of public money makes the matter one of vital importance.—*Brit. Dent. J.*, July 15, 1925.

Periodic Examinations of the Apparently Healthy: Recognition by the public of the value of periodic health examinations is shown by the increasing demand for such service. It does not seem to be generally understood, however, that attention to the physical condition is essential at every stage of development from the moment that life begins. In the prenatal period, of course, examination is made of the mother of the developing child. The health habits of the mother determine largely the future mental welfare of the infant. Prenatal care, adequately rendered as in New Zealand, has brought about notable diminution in the accidents of pregnancy and birth and improvement in the vigor and health of the infants. Every woman should be examined by a competent physician, preferably the one who is to attend at birth, as soon as she discovers that she is to have a child. She should be advised as to her diet, clothing, exercise, and work; and thereafter she should see the physician at such intervals as he thinks necessary. The remarkable accomplishments of the infant welfare movement, in private practice as well as in dispensaries and infant welfare stations, are ample evidence of the value of periodic physical examination of infants. The preschool age, between infancy and the beginning of attendance on the schools, only recently has begun to receive proper attention. This is the period when minor defects of the teeth, tonsils, ears and eyes should be detected and remedied. Frequent examinations of a normal, healthy child are not necessary at this age. One thorough, careful survey, perhaps conducted in two or three sittings, is sufficient. If the child has not been vaccinated against smallpox in infancy, he should be vaccinated as soon as possible. The physician may advise also that he be tested for susceptibility to diphtheria or scarlet fever and perhaps that he be inoculated against these diseases. Throughout young adult life the frequency and character of the physical examination are largely to be determined by the nature of the occupation and the living conditions. When one is entering on any new occupation, especially if its pursuit involves severe physical or mental effort, his fitness to undertake it should be determined by a survey of his condition. An annual examination thereafter is well worth while, but not so essential in early adult as in middle and later life. For the man or woman after 40, an annual physical examination is urgently to be advised, while from the age of 60 onward, examinations at least twice yearly are wise. The person who can have such attention paid to his physical condition as has been outlined, by a competent, conscientious and wise physician, is pretty certain to lead a comfortable and physically efficient life. The periodic health examination is the most helpful and worthwhile service that medical science of today can render.—*Hygeia*, September, 1925.

Normal Movements of Mandible: The study of the normal movements of the mandible is declared by S. Wilson Charles *(Brit. Dent. J.)* to be a study of the anatomy of the living person. He summarizes as follows: "The mandible is not depressed by the action of the so-called depressors (geniohyoid, digastric and platysma). It is depressed and elevated by the interaction of the four muscles—external pterygoid, masseter, internal pterygoid and temporal—acting as a group. These muscles are arranged in such a way that they hold the mandible in a sling and when in action are so arranged that the action of one portion (depression or elevation) is always opposed by the opposite portion of the group. The result is a controlled, balanced and rhythmic movement. The condyle does not act as a fulcrum or hinge about which the movements of the mandible take place and at no time is the condyle in

the most posterior part of the fossa. As the action of the depressor group is to draw the head of the condyle forward, it follows that on the slightest separation of the teeth the condyle has traveled forward and downward from its position of rest. During lateral movement the condyles both travel forward on the eminentia articularis and then return toward their positions of rest at different speeds; there is no justification for the theory that one condyle acts as a working or pivoting center and the other as a balancing point."

Values in Control of Environment: Experience and experiment will demonstrate in increasing measure the advantage of providing for man from birth to old age a healthy dwelling, in a carefully planned city, with protected food supplies, safe working conditions, and protection against insects, rodents and bacteria and their ravages. The acceptance of the above pronouncement does not involve any reflections of doubt upon the efficacy of diphtheria antitoxins, of smallpox vaccines, of annual medical examinations, of the large number of other extra-environmental accomplishments which are such amazing forerunners of a public health millennium. It is conceivable that the scientist may continue to attack disease through two media, environment and individual, with greater results than by abandoning each one in turn when new standard bearers appear in succeeding years. The public, volatile in mind and in action; delights in changing flags. It is the scientist who should apply the brakes to skidding principles of action.—Abel Wolman, in *Am. J. Pub. Health.*

Sunlight, Growth and Development: Whatever theories are proposed to explain the reactions, the fact remains that most plants and animals, including man, are as dependent upon the ultraviolet energy of sunlight for normal growth and development as they are upon the heat energy of sunlight. Other physiological functions besides bone development are interfered with when the organism is deprived of this kind of radiation. The body is more susceptible to the inroads of disease. A well-sunned body furnishes a high degree of protection against tuberculosis and the progress of the disease, even after it has been contracted, is often quickly and permanently checked. Window glass has unquestionably accelerated the speed of civilization, but man has paid the price.—W. T. Bovie, in *Scientific Month.*, July, 1925.

Edema and Nephritis: In any case of vascular disease, careful search should be made for possible infections. Of first importance, no doubt, stands syphilis. In cases where such a cause could be shut out with a fair degree of certainty, I have looked for infected tonsils, infected teeth, infected ears, and old genito-urinary infections as possible sources of microbic infection of the blood stream with thrombotic changes in the smaller capillaries of the parenchymatous organs and in the vasa vasorum of the larger blood vessels and it has seemed to me that through removal of such chronic foci of infection from accessible regions, together with a scheme of living which attempted to build up the natural resistance of the body to infection, greater relief was assured patients with cardio-vascular-renal disease than by our older methods.—Martin H. Fischer, *J. Indiana M. A.*, July, 1925.

Dislocation of the Jaw: The symptoms are very characteristic. If both joints are dislocated, as is usually the case, the mouth is widely open, and cannot be closed; the chin is advanced; the saliva dribbles, partly as a consequence of increased secretion from irritation of the parotid gland, and partly from deficient power of deglutition. There is a hollow just in front of the ear where the joint should be, and a prominence near the malar protuberance caused by the displaced coronoid process over which the fibers of the temporal muscle are stretched. If the dislocation is unilateral, the chin is generally much twisted to the opposite side. Reduction is generally very easy. The operator grasps the chin and jaw with both hands, the thumbs resting inside the mouth on the angle between the body and the ramus behind the third molars, while the fingers embrace the chin. The thumbs are, of course, protected with a towel, or they would be severely bitten as the jaw returns to its place. The perpendicular ramus is thus forced down, and the condyle disengaged from its unnatural position, while the chin is pushed back and raised. As soon as the condyle is disengaged, the tense fibers of the temporal and masseter muscles will contract and replace the jaw with a snap. The process in unilateral dislocation is similar, the main point being to disengage the

condyle, and then to assist the reduction by pressing the chin in the reverse direction to that in which it has been thrown by the violence. If the operator does not care to trust his thumbs inside the mouth, the posterior teeth may be separated by corks, while the chin is raised by the hands. The textbooks enjoin the subsequent application of a four-tailed bandage—it is entirely unnecessary. In the ordinary dislocation, the interarticular cartilage remains attached to the condyle; but there is a condition known as subluxation, in which the jaw appears to quit the interarticular cartilage, slipping before its edge, and locking the jaw with the mouth slightly opened. This condition usually subsides of itself. If necessary, it may generally be easily reduced by drawing the jaw directly downward and then manipulating it into place.—F. W. E. Wagner, in *Dent. Surg.*, Aug. 22, 1925.

Agranulocytic Angina: Agranulocytic angina is a condition which up to the present time has been reported solely in middle-aged women. All the cases have shown throat symptoms, particularly ulcers and an exudate on the tonsils that resembled diphtheritic exudate in some cases and, in most of the cases, became necrotic. Occasionally the entire tonsil sloughed out. Next in frequency have been exudation on an ulceration of the gums. The genitalia are involved, with processes similar in appearance. In a still smaller number of cases, ulcerations of the intestine and the skin have been found. The most characteristic anatomic change is found in the bone marrow, which appears to be the seat of the disease. The neutrophil cells of the marrow and their precursors are altogether missing or are greatly diminished in number, while the lymphoid and red-cell forming elements are slightly, if at all, reduced. The onset of the disease is usually sudden with pains in the throat and neck, high fever, normal findings in the organs, except as mentioned above, normal or varying findings in the blood or smears under bacteriologic examination, with no, or moderate, anemia, but with a very characteristic white cell and differential count (the white cells greatly reduced, in some of the reported cases as low as 600 with very few or no polymorphonuclear forms). In a case reported by Ulrich Friedmann, there was marked improvement under neoarsphenamin, but the patient died later of pneumonia.—Moore and Wieder, in *J.A.M.A.*, Aug. 15, 1925.

Hemophilia: The importance to dentist and patient of a knowledge that the latter is a bleeder is emphasized by Robert Friedmann (*Dent. Cosmos*, September, 1925). A foreknowledge of this condition may obviate fatal results of dental operations. Ordinary hemorrhage is checked by pressure, or the use of astringents, a cautery or drugs, tannic acid, epinephrin and potassium being most effective. In hemophilia, internal medication must be resorted to, and perhaps transfusion and an injection of horse serum when hospital facilities are available. In private practice, calcium lactate, thromboplastin or epinephrin may be employed. In a woman, aged 45, a hemophiliac, who underwent extraction of two teeth (cuspid and first bicuspid) with attached granulomas, under mandibular anesthesia, and one week later extraction of a second bicuspid and second molar, with removal of necrotic bone and curettage of the sockets, both operations were without untoward results. Calcium lactate was administered twenty-four hours before operation. Hemorrhage was controlled by packs, and excessive flow on removal of packing was checked by the employment of epinephrin.

Competitive Medicine: The Journal has repeatedly emphasized the belief that the medical practice of the future will be along preventive lines. The care of the sick has in the past been the rôle of the practitioner; the preservation of health will be his duty of the future if he is to continue a practice which will be of satisfaction to himself and of service to the public. Efforts in the direction of public health are gradually achieving success. The layman is beginning to appreciate the fact that many diseases are preventable and he is beginning to demand effective preventive rather than ineffective curative service. Better knowledge of the nature of disease and health, derived largely from the more enterprising members of the profession itself, is bringing about this demand for improved, effective medical attention.—*Boston M. & S. J.*, Sept. 17, 1925.

Announcements

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

American Medical Association, April 19-23, 1926, Dallas, Texas.

Dental Protective Association of the United States, December 21, 1925, Chicago, Illinois.

International Orthodontic Congress, August 16-22, 1926, New York City.

Pacific Coast Dental Conference, June, 1926, Portland, Oregon.

Seventh International Dental Congress, August 23-28, 1926, Philadelphia, Pennsylvania.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

National Capital at Washington, D. C., first Tuesday of every month.

December (1925)

Nevada, at Reno (12).
New York, First District (2-4).
Ohio, at Columbus (1-3).

January (1926)

Rhode Island, at Providence (13-14).

February (1926)

Minnesota, at St. Paul (10-12).

March (1926)

Louisiana, at New Orleans.

April (1926)

Alabama, at Birmingham (5-7).
Connecticut, at Bridgeport.
Kansas, at Wichita (19-21).
Michigan, at Detroit (12-14).
New Jersey, at Trenton (14-17).
North Carolina, at Richmond, Va. (13-15).
Texas, at Wichita Falls (20-23).
Virginia, at Richmond (13-15).

May (1926)

Illinois, at Springfield (11-13).
Indiana, at Indianapolis (17-20).
Maryland, at Baltimore (3-5).
Massachusetts, at Boston (3-7).
Missouri, at Jefferson City (17-19).
Montana, at Helena (26-28).
Nebraska, at Lincoln (17-20).
New York, at New York City (19-22).
South Carolina, at Columbia.
South Dakota, at Sioux Falls (11-13).
Tennessee, at Nashville (4-7).
West Virginia, at Clarksburg (17-19).

June (1926)

California, at Portland, Oregon.
Colorado, at Colorado Springs (9-12).
Georgia, at Savannah (9-11).
Maine, at Augusta (last week).
New Mexico, at Santa Fe (20).
Oregon, at Portland.
Washington, at Portland, Ore. (8-13).

July (1926)

Wisconsin, at Madison (14-16).

August (1926)

Pennsylvania, at Philadelphia.

November (1926)

Arizona, at Phoenix.

Baltimore City Dental Society, February 5-6, 1926.

California State Alumni Chapter, Psi Omega Fraternity, at Oakland, California, February 20, 1926.

Central Pennsylvania Dental Society, at Johnston, Pennsylvania, February 22-24, 1926.

Chicago Dental Society, at Chicago, January 27-29, 1926.

Marquette University Dental Alumni Association, at Milwaukee, Wisconsin, February 17-19, 1926.

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Arizona, at Phoenix, December 7, 1925. Secretary, Eugene McQuire, 104 Physicians Building, Phoenix, Arizona.

California, at San Francisco, December 5, 1925. Secretary, O. E. Jackson, 155 Kentucky Street, Petaluma, California.

Colorado, at Denver, December 1-5, 1925. Secretary, William H. Flint, Littleton, Colorado.

Delaware, at Wilmington, January 20-21, 1926. Secretary, W. S. P. Combs, Middletown, Delaware.

District of Columbia, January 4-8, 1926. Secretary, C. Willard Camalier, 206 Medical Science Building, Washington, D. C.

Iowa, at Iowa City, December 7-10, 1925.

Kansas, at Wichita, December 7, 1925. Secretary, George E. Burket, Kingman, Kansas.

Nevada, at Reno, December 9, 1925. Secretary, G. H. Marven, P. O. Box 56, Reno, Nevada.

North Carolina, at Raleigh, January 11, 1926. Secretary, F. L. Hunt, Asheville, North Carolina.

North Dakota, at Fargo, January 12, 1926. Secretary, W. E. Hocking, Devils Lake, North Dakota.

Oklahoma, at Oklahoma City, January 11-15, 1926. Secretary, L. M. Doss, 201 American National Bank Building, Oklahoma City, Oklahoma.

Pennsylvania, at Philadelphia and Pittsburgh, December 9-12, 1925. Secretary, Alexander H. Reynolds, 4630 Chester Avenue, Philadelphia, Pennsylvania.

Wisconsin, at Milwaukee, December 14-19, 1925. Secretary, S. F. Donovan, Tomah, Wisconsin.

ALABAMA DENTAL ASSOCIATION

The next meeting of the Alabama Dental Association will be held, April 5-7, 1926 at the Tutwiler Hotel, Birmingham.

F. F. PERRY, *Sec'y-Treas.*,
Montgomery, Ala.

THE BALTIMORE CITY DENTAL SOCIETY

The Baltimore City Dental Society has completed arrangements to hold a mid-winter clinic, Feb. 5-6, 1926. For further information, address

B. LUCIEN BRUN, *Chairman*,
827 Park Ave., Baltimore, Md.

CENTRAL PENNSYLVANIA DENTAL SOCIETY

The twenty-fourth annual meeting of the Central Pennsylvania Dental Society will be held at the Fort Stanwix Hotel, Johnston, Feb. 22-24, 1926.

G. B. WHITTEN, *President*,
548 Main St., Johnstown, Pa.
J. L. PORIAS, *Secretary*,
Nanty-Glo, Pa.

COLORADO STATE DENTAL ASSOCIATION

The next annual meeting of the Colorado State Dental Association will be held in Colorado Springs, June 9-12, 1926.

H. B. TALHELM, *Secretary*,
502 Mack Bldg., Denver, Colo.

KANSAS STATE DENTAL ASSOCIATION

The next meeting of the Kansas State Dental Association will be held at Wichita in the Forum, April 19-21, 1926.

C. K. WEAVER, *Secretary*,
Clay Center, Kan.

THE DENTAL SOCIETY OF THE STATE OF NEW YORK

The Dental Society of the State of New York will hold the fifty-eighth annual meeting at the Hotel Astor, New York City, May 19-22, 1926. All literary exercises, clinics and exhibits will be staged at the Hotel Astor.

Reduced railroad rates will be available, tickets on sale going May 15 to 20 inclusive. When purchasing a ticket, secure a certificate also. Deposit the certificate when you register.

The Society extends a cordial welcome to

all ethical dentists. Exhibitors are requested to address Dr. H. C. Bennett, Chairman of the Exhibit Committee, 576 Fifth Avenue, New York City, for information and space.

Educational Courses will be conducted on Monday, Tuesday and Wednesday, May 17, 18 and 19. Address Dr. Edward Kennedy, Chairman of the Educational Courses, 347 Fifth Avenue, New York City, for information and enrollment.

Make reservations early at the Hotel Astor.

A. P. BURKHART,
57 East Genesee St.,
Auburn, N.Y.

NEVADA STATE DENTAL ASSOCIATION

The annual meeting of the Nevada State Dental Association will be held in Reno on Saturday, Dec. 12, 1925, commencing at 9 a.m. All the meetings will be held in the Y.M.C.A., including the clinics.

It is very necessary that you notify the secretary as to your attendance so that we may know how many to provide for. So please drop him a card as soon as you can.

PROGRAM

9 a. m.—*Clinic on Oral Surgery*—By Dr. B. F. Coleman of San Francisco. Dr. Coleman will also display some instruments of his own design.

10:30 a. m. to 1 p. m.—*Porcelain Jacket Crowns*—By Dr. J. R. Gill, of the University of California, San Francisco.

2:30 p. m.—*Annual Business Meeting.*

A few reminiscences of California and Nevada Dental Societies by Dr. E. J. Howard, San Francisco.

Report by Dr. Carr on the Western Dental Congress, held in San Francisco on October 26-27.

9 a. m. to 6 p. m.—Exhibits by James W. Edwards Company. Exhibits by S. S. White Company and others.

6:30 p. m.—*Banquet at the Golf Club.*—Automobile transportation will be provided to and from the Golf Club for all the members and visitors.

GEORGE A. CARR, *Secretary*,
216 F. & M. Bank Bldg., Reno, Nev.

RHODE ISLAND STATE DENTAL SOCIETY

The annual meeting of the Rhode Island State Dental Society will take place at the Biltmore Hotel, Providence, Jan. 13-14, 1926.

AMBROSE H. LYNCH, *Chairman*,
Executive Committee,
206 Jackson Bldg., Providence, R. I.

SOUTH DAKOTA DENTAL SOCIETY

The forty-fourth annual meeting of the South Dakota State Dental Society will be held in the Coliseum, Sioux Falls, May 11-13, 1926.

ERNEST W. ELMEN, *Secretary*,
Sioux Falls, S. Dak.

TENNESSEE STATE DENTAL SOCIETY

The fifty-ninth annual meeting of the Tennessee State Dental Association will be held in Nashville, May 4-7, 1926.

J. B. JONES, *Secretary*,
Murfreesboro, Tenn.

TEXAS STATE DENTAL SOCIETY

The forty-sixth annual convention of the Texas State Dental Society will be held at Wichita Falls, April 20-23, 1926. The outstanding feature of this meeting will consist of six postgraduate clinic courses to be conducted by leading men of the profession.

F. F. BROWN, *President*,
Wichita Falls, Texas.
J. G. FIFE, *Sec'y-Treas.*,
Medical Arts Bldg., Dallas, Texas.

DELAWARE STATE BOARD OF DENTAL EXAMINERS

The next meeting of the Delaware State Board of Dental Examiners will be held in the Municipal Building, Tenth and King Sts., Wilmington, Jan. 20-21, 1926, 9 a. m. to 5 p. m. For further information, address

W. S. P. COMBS, *Secretary*,
Middletown, Del.

BOARD OF DENTAL EXAMINERS OF THE DISTRICT OF COLUMBIA

The next examination of the Board of Dental Examiners of the District of Columbia

for dentists and dental hygienists will be held Jan. 4-8, 1926.

C. WILLARD CAMALIER,
Secretary-Treasurer,
206 Medical Science Bldg.,
Washington, D. C.

ALPHA OMEGA DENTAL SOCIETY

The eighteenth annual convention of the Alpha Omega (Dental) Fraternity will be held at the Prince George Hotel, Toronto, Canada, Dec. 28-30, 1925. For further details, address

S. H. BOWMAN, *Supreme Scribe*,
2435 North Seventeenth St.,
Philadelphia, Pa.

CALIFORNIA STATE ALUMNI CHAPTER, PSI OMEGA FRATERNITY

The annual meeting of the California State Alumni Chapter of the Psi Omega Fraternity will be held at the Athens Athletic Club, Oakland, Saturday, Feb. 20, 1926.

The general meeting will convene at 2 p.m. for initiatory and degree work, business session and election of officers. A banquet will be held at 6:30 at the Club, for which reservations must be made of the Secretary.

ARTHUR R. MCDOWELL, *Grand Master*,
344 Fourteenth St.,
San Francisco, Calif.
JOHN E. GURLEY, *Secretary*,
350 Post St.,
San Francisco, Calif.

ACADEMY OF STOMATOLOGY PHILADELPHIA

GILDERSLEEVE STUDY CLUB

The committee on the Gildersleeve Study Club announces a course of clinical lectures, probably twelve in number, on "Pyorrhea Alveolaris," by Dr. Hermann Prinz. Dr. Prinz has in recent years given this subject especial attention, including several months spent in visiting the more prominent clinics of northern Europe. These lectures will be followed by an afternoon clinic by Dr. Paul Stillman, of New York City. The next week, Drs. Mershon and Le Roy Johnson will discuss the problem of occlusion as it relates to occlusal trauma. The lectures will be given on Friday evenings, at 7:30, beginning Dec. 4, 1925.

MARQUETTE UNIVERSITY DENTAL ALUMNI MEETING

The twentieth annual meeting of the Marquette University Dental Alumni Association will be held at the Auditorium, Milwaukee, Wis., Feb. 17-19, 1926.

J. V. SENGPIEL, *Secretary*,
695 Astor Street,
G. W. WILSON, *Director of Exhibits*,
May Bldg., 36th St. and North Ave.
Milwaukee, Wis.

SIXTH ANNUAL MEETING OF THE AMERICAN DENTAL GOLF ASSOCIATION

Louisville, Kentucky, Sept. 20-25, 1925

Many golfers were on hand, Sunday, September 20, to take advantage of playing privileges in the afternoon at the Audubon Country Club. However, the tournament really began Sunday evening with the Calcutta Pool Dinner in the Rathskeller of the Seelbach Hotel.

Monday morning, September 21, the qualifying play began at the Audubon Country Club, 132 registering and 121 qualifying. Of this number H. G. Grubb turned in the lowest score, 78, and G. T. Gregg the next lowest, 79.

The final play occurred on Friday, September 25, with a registration of more than fifty. Other than the championship and handicap flights, each player irrespective of his qualifying score played 18 holes medal play in his class for the low gross trophy and low net trophy, the first 18 holes of the championship and handicap rounds applying in the class events. The winners were as follows:

Champion—G. T. Gregg, Pittsburgh, Pa. Gross score 159.

Runner up—F. M. Casto, Cleveland, Ohio. Gross score 162.

Handicap flight—J. G. Williams, Atlanta, Ga. Net score 138.

Runner up—J. D. Jordan, Little Rock, Ark. Net score 143.

Class "A"—Thomas P. Hinman, Atlanta, Ga. Gross score 82.

Runner up—A. Browning, Kansas City, Mo. Net score 74. Also W. J. Dierks, Toledo, Ohio. Net score 74.

Class "B"—D. A. House, Indianapolis, Ind. Gross score 87.

Runner up—M. J. Couch, Chicago, Ill. Net score 71.

Class "C"—Roy Wilson, Chicago, Ill. Gross score 89.

Runner up—J. G. Williams—Atlanta, Ga. Net score 92.

Class "D"—B. O. Haun, St. Louis, Mo. Gross score 104.

Runner up—F. C. Rogers, St. Louis, Mo. Net score 80.

Prizes for these events were:

Williams' trophy—Williams Gold Refining Co., Buffalo, N. Y.

Brassie and driver (Jack White's)—Dr. C. W. Roberts of London, England.

Listerine cup—Lambert Pharmacal Company, St. Louis, Mo.

Silver cigarette case—Spyco Smelting & Refining Co., Minneapolis, Minn.

Golf bag—The Lavoris Chemical Co., Minneapolis, Minn.

Two books—The C. V. Mosby Co., St. Louis, Mo.

Prize presented by The Pepsodent Company of Chicago, Ill.

Prize presented by the August E. Drucker Company of San Francisco, Calif.

Prize presented by the E. R. Squibb Co., of New York City.

Anacin Tablets presented by The Heidbrink Co., Minneapolis, Minn.

Prize presented by the Association.

Putter presented by Hugo Friedman of Chicago, Ill.

During the entire week of the Session of the American Dental Association these prizes and trophies were on display in the writing room of the Brown Hotel.

The following officers and directors were elected: president, Frank M. Casto, Cleveland, Ohio, (three year term); vice president, R. E. Denney, Philadelphia, Pa.; secretary treasurer, Thomas P. Hinman, Atlanta, Ga.; directors: D. D. Campbell, Kansas City, Mo., (four years); F. D. Miller, Altoona, Penn., (five years).

The following resolution was passed:

Manufacturers are permitted to play in the tournament but compete only in the class events and not in the championship and handicap flights. They are also included in the Calcutta Pool.

Already plans are being made for the 1926 meeting, in Philadelphia. Golfers, the minute you receive your new appointment book, reserve plenty of time for the Seventh Annual Tournament.

BOOKS RECEIVED

Who's Who In Dentistry. Biographical Sketches of Prominent Dentists in the United States and Canada. Edited by Samuel Greif, D.D.S., Vol. 2. Brooklyn, N. Y.: Who's Who Dental Publishing Company, 1925.

This is an enlarged edition of the previous volume, the number of biographies having been trebled.

Royal Dental Hospital of London Annual Reports for 1924. Edited on Behalf of the Medical Committee by A. T. Pitts, D.S.O., L.R.C.P., M.R.C.S., L.D.S. London: John Bale, Sons & Danielsson, Ltd., 1925.

PATENTS OF INTEREST TO DENTISTS

1467079. Dental appliance, John M. Wilson, San Diego, Calif.

1467789. Orthodontist's locking device, Edward M. Griffin, Portland, Oregon.

1467850. Dental film holder, Daniel L. Hall, Columbia, S. C.

1467851. Dental film holder, Daniel L. Hall, Columbia, S. C.

1467874. Dentist's drill cleaner, W. M. Muchow, Evanston, Ill.

1467876. Film packet for X-ray work, H. R. Raper, Albuquerque, Ill.

1467455. Dentifrice, Oscar F. Schmid, Jackson, Mich.

1467956. Dental attachment, Jacob J. Stark, Brooklyn, N. Y.

1468461. Artificial denture, James L. Dickson, Chinook, Mont.

1468125. Toothpick, Andrew C. Neilson, Cleveland, Ohio.

1468074. Anchoring device, Ralph S. Pierce, Hinsdale, Ill.

1468063. Dental instrument, Louis J. Weinstein, New York, N. Y.

Copies of the foregoing patents may be obtained for twenty-five cents each, by addressing John A. Saul, Solicitor of Patents, 509 Seventh St., N. W., Washington, D. C.

Always Write These Six Words

By Ernest V. Madison

PROBLEM: How can a publisher supply to his subscribers for 35 cents an issue (twelve issues at a subscription price of $2.50 per year) a publication that it actually costs him more than 35 cents a copy to edit, illustrate and print?

Here we have an exact condition of publishing. The subscription price of a publication, if considerate of the reader's pocketbook, will not pay the cost of paper stock, publishing, printing and mailing.

What, then, can be the good fairy that enables American publishers to produce at moderate subscription rates the best publications in the world?

It is that distinctly American institution—the advertisement. The revenue from the advertising pages pays the deficit and enables the publisher to service his paper to the reader at a moderate subscription price.

Advertisements, therefore, work to the reader's benefit in more ways than one. They are interesting, educational reading. They are messages of progress. They bring to him in printed form the vital matter of the editorial pages at a fractional charge of the actual cost of compilation, reproduction and distribution.

For this reason, whenever you take up your pen to write to an advertiser in this paper, you should also add the words "I read your ad in THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION."

Such consideration on your part lets the advertiser know of another specific instance wherein his advertising has been read; encourages him to continue it; and helps maintain a low subscription price on this and other publications.

Prophylaxis

THE scientific basis for prophylaxis either at the chair or as practiced by the patient at home is the elimination of the mouth bacteria and their food supply.

Kolynos Dental Cream has been demonstrated to be actively germicidal by Professor Leo F. Rettger, Department of Bacteriology, Yale University, Professor Loeffler the discoverer of the Diphtheria bacillus, Doctors Thresh and Beale of the London Hospital Medical College.

Oral bacteria are the direct cause of dental caries. Therefore the use of a dentifrice which materially reduces the number of these organisms without injury to the mouth tissues, aids the dentist to check tooth decay. Kolynos Dental Cream is such a dentifrice.

May we send Professional Samples?

THE KOLYNOS COMPANY
NEW HAVEN, CONN.

KOLYNOS CLEANS WITHOUT GRIT

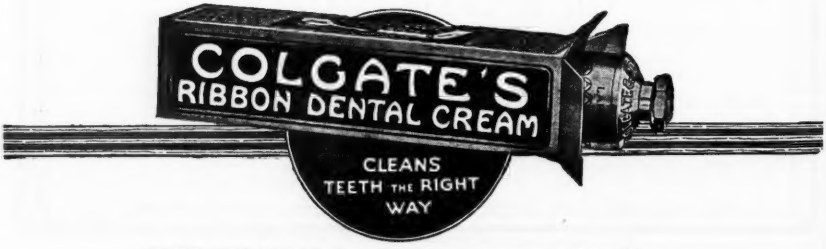
Soap—
The Most Effective Cleansing Agent Known

Fones, Prinz, Marshall, Brody and other dental authorities recognize the effective cleansing action of soap in a dentifrice. They list it as an ingredient of prime importance.

Colgate's Ribbon Dental Cream cleans the teeth by the combined action of mild soap and precipitated chalk. Clinging food particles are gently loosened and washed away. The value of Colgate's as a safe and effective dentifrice is widely recognized by the dental and medical professions.

A generous supply of samples will be sent postpaid to professional friends upon request.

Dental Dept. 668
COLGATE & CO.
581 Fifth Avenue, New York



PROPHYLACTIC TOOTH POWDER

Dissertations on Dentistry, by M. L. Rhein, M.D., D.D.S.

(Continued from November)

Copyright, 1925, Prophylactic Tooth Powder, Inc.

CHAPTER II—PERIODONTOCLASIA

From this we pass to consider the more serious toxic activities in the digestive tract, of which ptomain toxemia is a good example. In such cases a degree of stomatitis starts up, the severity and symptomatology of which is dependent upon the nature and activity of the toxins.

The pyorrhetic condition of the mouths of sailors in extreme latitudes who lack proper amount of vitamins in their food content has been graphically described by all kinds of writers. Notwithstanding this, forty years ago infantile scorbutus was not known to the internist. Children by the score died in great agony from this condition of virtual starvation. "Died from rheumatism" was the physician's inscription on their death certificate. Never have I seen such terrible destruction of dental tissues as I saw in those days of child starvation. The following case published by me in a discussion of a paper by E. C. Kirk on Infantile Scrobutus should be very enlightening: (To be continued)

PROPHYLACTIC TOOTH POWDER, the *two purpose* dentifrice, removes without either abrasion or decalcification, the mucinate film.

It leaves the mouth reaction antacid for over eight hours.

We have yet to hear of the first case of that exquisite pain from acid erosion where the sensitiveness has not entirely disappeared after intelligently using *Prophylactic Tooth Powder.*

For personal trial a sample can of Prophylactic Tooth Powder will be sent to any dentist or registered hygienist. Follow the printed directions accompanying the can.

PROPHYLACTIC TOOTH POWDER, INC.

BOX 38, STATION Y NEW YORK CITY

Patented in: United States, Canada, England, France, Belgium, Norway, Australia, New Zealand, Sweden, Hungary, Italy.

Say: "I Saw it in THE JOURNAL"

Beyond the Mirror's Reach

And even beyond detection by the "explorer" are conditions of dental disease which only radiographs can indicate.

The profession is becoming so strongly convinced of this that the time is not far distant when a complete set of radiographs will be a part of all routine examinations.

If you are not equipped for making radiographs send your patients to a competent radiodontist.

It's worth it to *know*

Eastman Kodak Company

Medical Division Rochester, N. Y.

AN IVORY BILLIARD BALL is not more smooth than Caulk Cement. Take particular notice of the surplus that sets on the slab. When it hardens, the texture becomes smooth, hard, and glossy like fine ivory. Such fine texture is one of the signs of strong and reliable cementation for any piece of work. On your next order remember to *specify*

CAULK CEMENT

6 Powders — 4 Liquids — $8.00

Two Economical Packages — $15.00

Wadsworth Universal Articulator

Patented

The outstanding features of the Wadsworth Universal Articulator are, ADJUSTABLE CONDYLES — INTER-CONDYLAR WIDTH ADJUSTMENT — ADJUSTABLE INCISAL GUIDE PLANES—RADIAL CENTERING PLATE.

This instrument with its attachments permits accurate reproduction of condylar and mandibular movements in any and every case, whether full or partial restoration is required, or whether the treatment extends into the field of orthodontia or periodontia.

No other instrument provides means for scribing the basic dental curve as does the centering plate on the Wadsworth Universal Articulator.

It is not limited to normal cases, but because of its adjustability abnormal case requirements are handled with equal accuracy and efficiency.

A complete booklet has been prepared, fully describing and illustrating the articulator and its universal adaptability.

Those interested may have a copy on request.

Wadsworth Universal Articulator
$25.00

For Sale by Dealers and our Houses

THE S. S. WHITE DENTAL MFG. CO.
"Since 1844 the Standard"
PHILADELPHIA

The *Vital* Difference

By C. H. Woodward

"Wheat is wheat," said some one, "so why should ***Whole Grain Wheat*** be superior to any other wheat product, or product made of wheat?"

"Paper is paper," said another, "but if one piece has the Government's promise to pay on it, it is money, but *it is still paper.*"

One paper possesses something the other paper lacks—and it makes a lot of difference.

Whole Grain Wheat possesses something all other wheats (or products made of wheat) lack—and it makes a vital difference.

Take away from the paper the Government's promise to pay and it no longer functions as money.

Take away from wheat any of the promises Nature endowed it with and it no longer functions as food.

And that is true of beans, and peas, and lentils and all other natural substances.

THUMBPRINT Products—***Whole Grain Wheat, Whole Grain Rice, Whole Navy Beans, Whole Lima Beans, Whole Red Kidney Beans, Whole Lentils, Whole Ripe Peas, and Liquid Life*** all bear the thumbprint of Nature by which they are identified as Natural foods for replenishment of the human bloodstream.

They bear Nature's promise to pay.

These same foods when denatured do not bear Nature's promise, and are like the paper that lacks the Government's promise to pay—it will not function as money.

Denatured foods create disease, not because of what such foods contain, but *because of what they lack.*

> "My own experiments conducted with hundreds of albino rats of the Tyler strain conclusively prove that ***Whole Grain Wheat*** surpasses in nutritive properties any other Grain Food known to the American Public."
>
> Alfred W. McCann
> *Author of "Science of Eating"*

"Man cannot change the air he breathes, nor the water he drinks, nor the nature of the foods he eats, because his vital relations are forever fixed."—John Burroughs.

Denatured foods cause your teeth to decay; they shorten your life; they depreciate your mental and physical ability; they stand in your way of achievement; they double your cost of living and cheat you of your life at the same time.

Civilized man has unthinkingly tried to change the nature of the food he eats, by separating it into parts and rejecting some and choosing others; by cooking his food in the presence of oxygen and thereby denaturing it.

THUMBPRINT Products are cooked ready to eat, but they are whole natural substances and are not cooked in the presence of oxygen. They are prepared and cooked under a patented process which prevents the loss of any element and thus prevents changing their nature.

These foods are not "cures" nor "remedies" in the sense usually understood, but more than 75 human ailments have disappeared out of the lives of users of THUMBPRINT products. These ailments disappear because the individual quits creating the condition by substituting natural food for unnatural food.

THUMBPRINT Products are never sold through stores because they reduce the grocery bill, but directly to the consumer by our own sales organization. Look in your telephone directory for ***Whole Grain Wheat*** Distributor, or send your order directly to ***Whole Grain Wheat Company,*** 1802 Sunnyside Ave., Chicago, Ill.; Denver and east $2.00 per dozen 11 ounce (net) tins; 4 dozen $7.60; west of Denver $2.25 per dozen; 4 dozen $8.30, all delivered.

GOLD
SILVER COPPER
PLATINUM
PALLADIUM IRIDIUM

ALLOYS AND PURE METALS

IN THE FORM OF

CASTING INGOTS
PLATE-WIRE
SOLDER-FOIL
SHAPED BARS
ATTACHMENTS

FOR EVERY EXACT
REQUIREMENT OF DENTISTRY

SANTA MONICA, CALIFORNIA

Lighted by Radio

and what this means to Williams quality

An electric bulb held in the hand will light when placed in the pathway of the current that is "broadcasted" into the Williams Radio Furnace

HERE is a simple illustration of the principle of the Williams Radio Furnace. When metals are placed in a cold crucible with no heat inside or outside of it, they establish a contact with the "broadcasted" current, just as the bulb held in the pathway of the same current is caused to light.

This current melts and vigorously stirs the molten metal thousands of revolutions a minute, preventing segregation and producing a homogeneous alloy every time—something that could not be done by old methods.

Both the melting and casting is done in vacuum, preventing oxidation and blow-holes. For perfect results insist on Williams Gold—melted by radio.

THE WILLIAMS GOLD REFINING CO.
Smelters and Refiners
2978 Main Street, Buffalo, N. Y.
Bridgeburg, Ont.

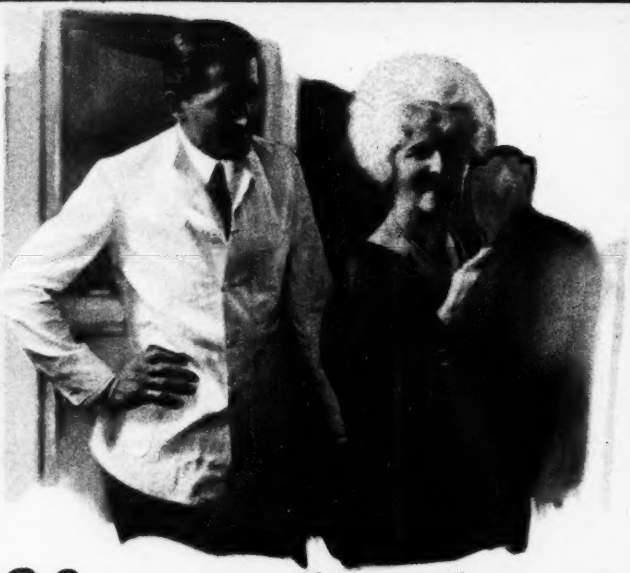
Williams Golds

Melted by Radio

Casting Gold Lingual Bars Filling Golds

Plates Shells Wire Solders Clasps Nuggets

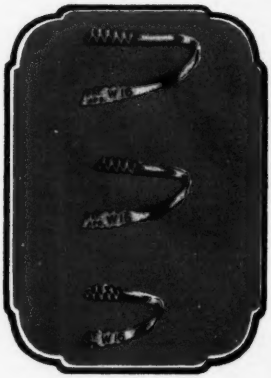
(See announcement on reverse side)



Of course she's pleased

her dentist used a

Williams
Ready Made
Lingual Bar



SCRAP GOLD

This is the month to send in your accumulation of scrap gold, filings, sweeps, etc. ***Our Motto*** — 100% returns; a fair charge for our work.

You can ship through your dealer or direct. Wrap your packages securely.

THE WILLIAMS GOLD REFINING CO.
Smelters and Refiners

2978 Main Street
Buffalo, N. Y.

Bridgeburg
Ontario

Williams Golds
Melted by Radio

Casting Gold **Lingual Bars** **Filling Golds**
Plates **Shells** **Wire** **Solders** **Clasps** **Nuggets**

(See announcement on reverse side)

NUFORM TEETH

TRADE MARK REGISTERED

Less Grinding, Better "Grinders"

Great care has been taken, in the creation of NUFORM TEETH, to approach perfection in occlusal surfaces. A result of this insistence on our part is less work for the laboratory man—these teeth slip into place easier, require less grinding. A more important result, however, is increased satisfaction to the patient, better articulation and mastication.

Artificial Teeth have had to bear a variety of nomenclature, ranging from "tombstones" to "store teeth," but a closer copying of Nature's shades and tintings, her outlines and contours, have established for NUFORM TEETH a reputation of being

"As nearly perfect substitutes for natural teeth as it has yet been possible to make"

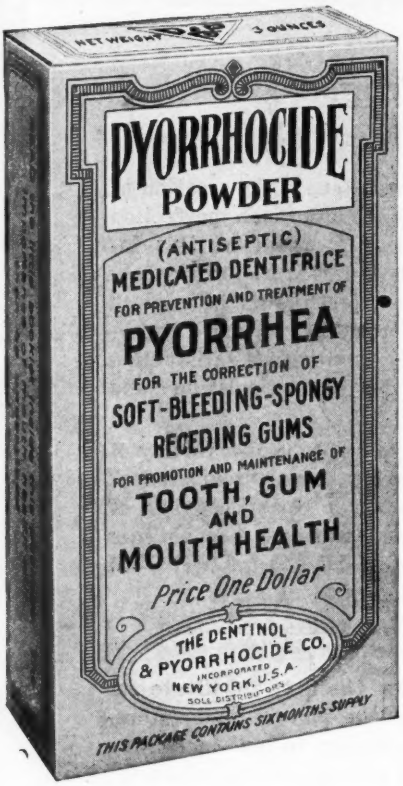
It is a far cry from the first substitute for a natural tooth to the Nature-like restorations we are supplying to an increasing number of dentists who are vitally interested in creating "natural restorations" for their patients.

Write today for illustrated mold chart

UNIVERSAL DENTAL COMPANY

48th and Brown Streets **Philadelphia, Pa.**

The profitable experience of one dentist can be duplicated by another dentist, in the use of



PYORRHOCIDE POWDER

(Antiseptic)

Prescribe it for soft, bleeding, spongy gums. Prescribe it in all pyorrhetic cases.

It will reduce soreness and inflammation of diseased oral tissue.

It keeps the teeth clean—the gums hard.

Pyorrhocide Powder is medicated with Dentinol (3%)—a non-toxic, non-caustic germicidal and healing agent used in pyorrhea work at the chair.

Prescribe Pyorrhocide Powder—Compare Results

Samples: *Pyorrhocide Powder samples for distribution to your patients, and a trial bottle of Dentinol for use at the chair, sent free on request.*

The Dentinol & Pyorrhocide Co., Inc.

Sole Distributors

1480 Broadway **New York**

And We'll Keep At It During 1926

EVERY day during the past year our casting golds have made it more difficult for competitors to truthfully declare their product to be "just as good" as Julius Aderer's

DENTURCAST
TRADEMARK

CASCLASP
TRADEMARK

DENTURE and CLASP CASTING GOLDS

each grade of which is skillfully processed for a distinct purpose and to fulfill that purpose with distinction. Hence, prosthodontists everywhere know that "Julius Aderer's Products are Inseparably Linked with Satisfactory Results."

Permit us, at this time and place, to extend to you the Compliments of the Season and to continue to be a factor, however humble, in the greater success we wish you for 1926.

Never Yet An Inducement To Change

FROM the prosthodontist standpoint—the one whose experience has taught him to prefer the

Julius Aderer Grooved or Split Lingual Bars

—there never was, is, nor can be a readymade lingual bar that will as successfully answer his exacting purposes. In fact, the Julius Aderer's Lingual Bar is the real solution of your lingual bar troubles. To be lastingly satisfied you have but to employ them once.

THESE BARS HAVE A bulldog grip or anchorage in the vulcanite; are contoured so that they fit the majority of cases; may be bent and re-bent as often as required to fit the unusual case; occupy minimum space in the mouth; have strength, durability, less bulkiness.

16-Solid Clasp Gold, large $2.50; Medium $2.25; Small $2.00. 1/8th Gold Cased in any of the three sizes $1.50 each.

Julius Aderer's Readymade Lingual Bars are recommended and sold by reputable dealers everywhere.

JULIUS ADERER, Inc., *Manufacturers*
Main Office: 47 W. 42d STREET, NEW YORK, N. Y.

DEVITALIZED TEETH

Will Long Be A Topic of Dispute

Whether you agree with the extremists or hold more moderate views, all must concede that restorations employing, *Strelo* Interchangeable Facings and Posteriors can be constructed in harmony with the most advanced thought, or the simplest form of application;

whether it be fixed, removable, porcelain root cones, or whatever you desire, *Strelo* Interchangeable Facings and Posteriors are adaptable for the case.

Their interchangeable features, precisely maintained, [make] them superior for all bridgework.

Technical Inquiries Solicited

The Columbus Dental Mfg. Company

COLUMBUS, OHIO, U.S.A.

Not too harsh, not too mild

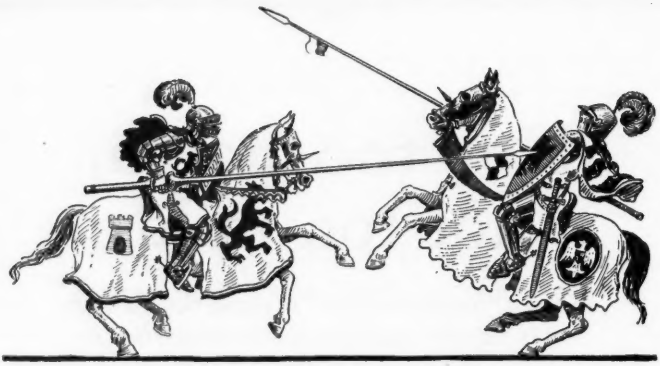
—but a "happy medium" in dentifrices, which is rapidly gaining the enthusiastic approval of the profession.

WE have prepared this product to conform strictly to what we believe a dentifrice should be—an efficient cleansing agent. A happy medium, in other words, between those preparations which fail to prevent the formation of tartar and those which are so harsh as to scratch and damage the enamel. (The base of P D & Co Tooth Paste has a hardness of approximately 2.75 to 3, according to Mohr's scale.)

Frankly, we believe it the kind of dentifrice that dentists will feel like recommending to their patients.

No samples of P D & Co Tooth Paste are available at the present time, but we shall be pleased to mail, with our compliments, a full-size package to any member of the profession who requests it.

PARKE, DAVIS & COMPANY
DETROIT, MICHIGAN



"In Days of Old, When Knights were Bold"

When upon the integrity of his mailed armor depended the life of the warrior, the armor-makers recognized the universal principle of the Round Rivet.

Armored Knights are a thing of the past, but the more highly developed mechanical skill of the 20th Century has seen no good reason to depart from the principle handed down through the ages—"round rivets to withstand shearing stress."

ROUND RIVETS IN UNIVERSAL FACINGS

exemplify the same adherence to a sound principle.

Plus this secure method of retention, the dental profession have found that UNIVERSAL FACINGS have other superior features—a fine grade of porcelain, an ease in grinding, a freedom from chipping, a high susceptibility to polish.

"A Good Tooth Made Better"

Made by the manufacturers of **NUFORM TEETH** and U.S.P. Teeth

Universal Dental Company

48th and Brown Sts. **Philadelphia, Pa.**

CRANDALL'S
SCIENTIFICALLY TESTED
NON-ZINC ALLOY

Examine a few grains of Crandall's Alloy with a magnifying glass. The small, hard particles are as bright and sharp as burnished steel. A more bulky alloy requires more mercury for amalgamation and a large proportion of this mercury is expressed later, resulting in a waste of alloy and mercury and a less stable filling.

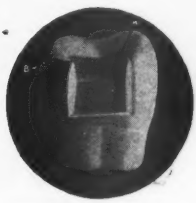
There are more fillings in a bottle of Crandall's Alloy, and they are stronger fillings because of its high silver content and its density.

Order Clev-Dent Products from your Dealer.

THE CLEVELAND DENTAL MFG. CO.
3307 Scranton Road
CLEVELAND, OHIO, U. S. A.

CLEV-DENT

Typical cavities prepared for restoration with Crandall's.

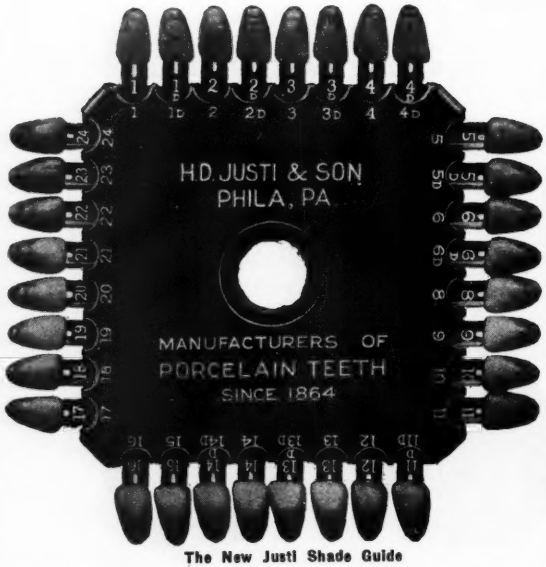


"Pinoro"

The New Justi Gold Pin Tooth

THESE TEETH are True-to-Nature molds, which have had such a wide professional indorsement. They illustrate the famous Justi shades, that are the standards of comparison in artificial teeth. The porcelain has not been duplicated for strength, translucency and depth of texture.

The anterior molds have recently been perfected, and seven posterior molds added, thus meeting every practical demand.



The New Justi Shade Guide

Ask Your Dealer for Justi Price List, or Write to Us

H. D. Justi & Son
Manufacturers of Porcelain Teeth Since 1864
32d & Spring Garden Sts.,
PHILADELPHIA, PA.
U. S. A.

Announcement regarding the Justi Ekloform Teeth will appear in the January Journals.

Our Aim

is to provide the dental profession with the best that modern science knows . . . *today*

PEPSODENT is based on the dominant dental theories of *today.*

It has no past to live up to . . . no inherited tenets to consider.

Should dental science, tomorrow, find a way to further improve its power, we should at once adopt it . . . *and frankly tell you so.*

Our only claim for Pepsodent is that it is made today to meet the requirements of today . . . that it embodies the *latest* scientific findings.

We believe that is what you seek for your patients, is it not?

Then let us send you our brochures, advise you just what we are doing for the better protection of teeth, for oral prophylaxis.

Both of us, we believe, are working to the same end:

You to provide the best that modern dental practice knows in the treatment of your cases.

We to provide the best that modern science knows in a tooth paste to fit in with your own work.

The coupon will bring you matter that will interest you, and a full size tube of Pepsodent to try.

Pepsodent PAT. OFF. REG. U. S.

The New-Day Quality Dentifrice
Endorsed by World's Dental Authority

THE PEPSODENT COMPANY
5705 Ludington Building, Chicago, Illinois

Please send me, free of charge, one regular 50c size tube of Pepsodent, with literature and formula.

Name.....

Address.....

Enclose card or letterhead 1812

Hidden wells of poison

That is the keynote thought back of the present Listerine Tooth Paste campaign now appearing in magazines and newspapers the country over.

Thousands of dentists have written in to us commenting favorably on this new and drastic publicity.

We have also prepared an attractive folder reprint of this advertising, copies of which many dentists are using, together with samples of this dentifrice.

May we send you a supply of folders and samples? A postal request will bring them.

LAMBERT PHARMACAL CO.
St. Louis, Mo.

Makers of Listerine and Listerine Tooth Paste

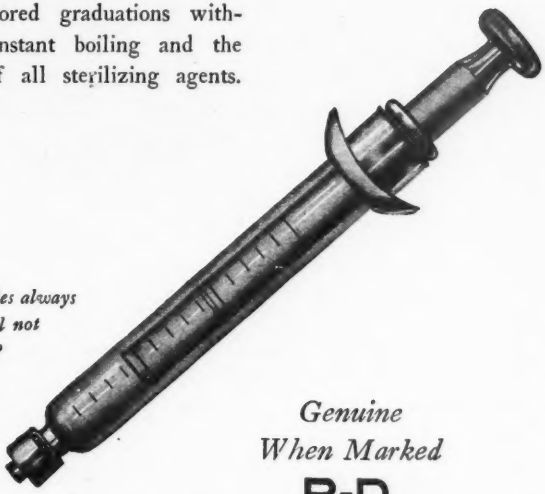
Say: "I Saw it in THE JOURNAL"

B-D PRODUCTS

Made for the Profession

LUER-LOK POSNER
DENTAL SYRINGES

Genuine Luer, B-D Syringes now have Indestructible Scales and are accurately calibrated. The colored graduations withstand constant boiling and the action of all sterilizing agents.



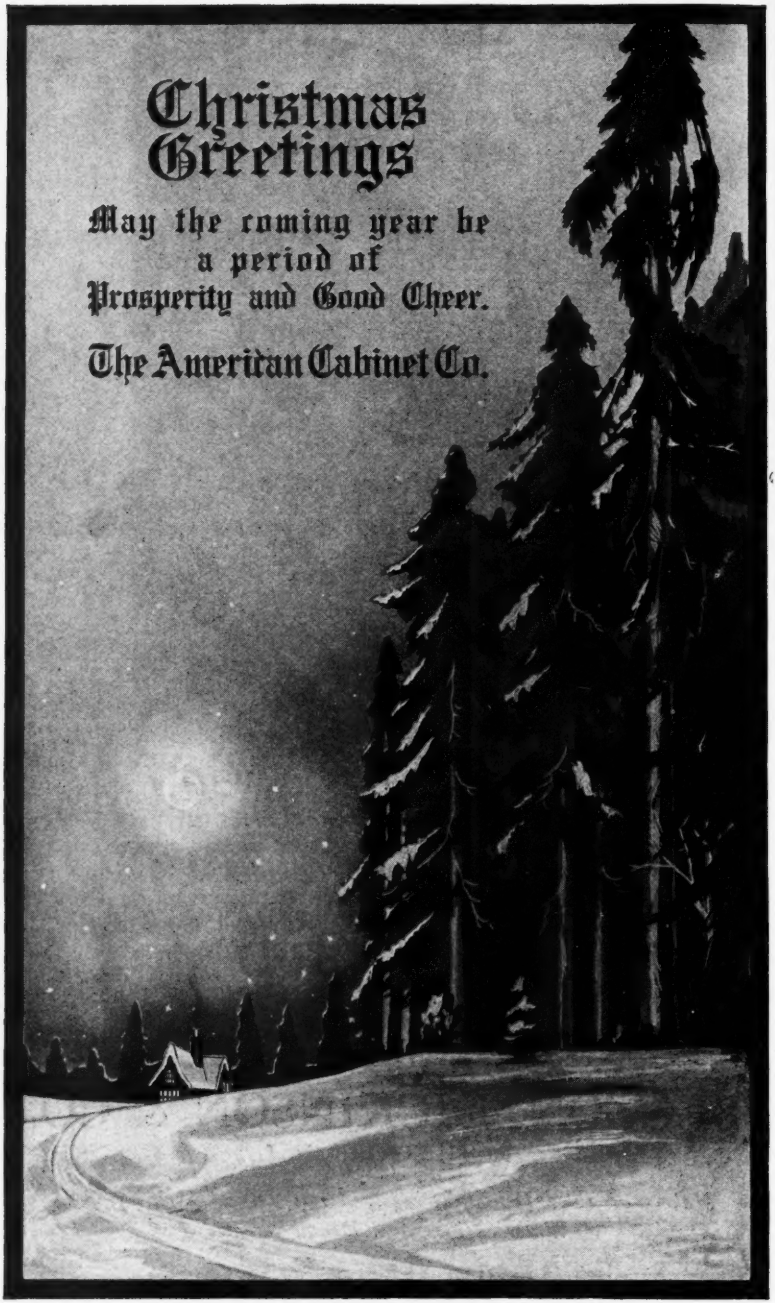
Yale Needles always fit and will not "jump off"

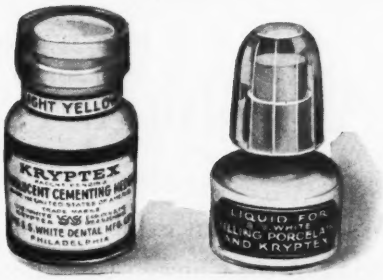
Genuine When Marked
B-D

SOLD THROUGH DEALERS

BECTON, DICKINSON & CO.
RUTHERFORD, N. J.

Makers of Luer Dental Syringes, Asepto Dental Syringes, B-D Water Syringes and Dental Needles.


Christmas
Greetings
May the coming year be
a period of
Prosperity and Good Cheer.
The American Cabinet Co.



KRYPTEX

A New Cementing Medium For Crowns, Inlays and Bridges

ITS tensile strength is a hundred per cent greater than that of the best zinc cement and it is fifty per cent stronger in crushing strength. It is far more permanent—does not expand or contract—is extremely tenacious—mixes and packs with the greatest ease—and it is translucent.

You may know much about dental cements but until you have given Kryptex a trial you have never experienced such perfect cementing results as may be obtained with this new cementing medium.

An illustrated booklet will give you full particulars. Ask for a copy, and for a sample to make your own test.

For Sale by Dealers and our Houses

The S. S. White Dental Mfg. Co.

"Since 1844 the Standard"

Philadelphia

A.D.J.

The S. S. White Dental Mfg. Co., 211 So. 12th Street, Philadelphia, Pa.
Please send me free sample of KRYPTEX and booklet.

Dr. _____

Address _____

City _____ State _____

Dealer's Name _____

At Chicago

WE WILL have an exhibit at the January meeting of the Chicago Dental Society and if you are interested in things prosthetic, we want to see you.

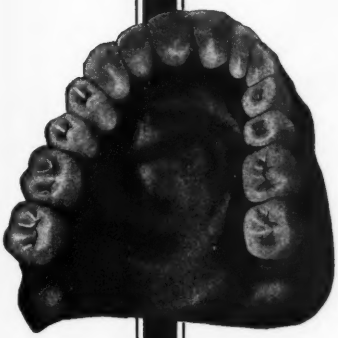
The Lewis Automatic Electric Vulcanizer (simplified model) will be on display, and also the Multiple Heat Electric Vulcanizer. We will show Rotary and Motor Blowers for Blowpipe work; Electric Ovens for drying out inlay flasks; a very comprehensive line of vulcanite flasks, as well as other articles of interest to workers in the prosthetic field.

Two representatives from the factory will be in attendance, and you will find this an excellent opportunity to get first hand information with regard to dental laboratory appliances.

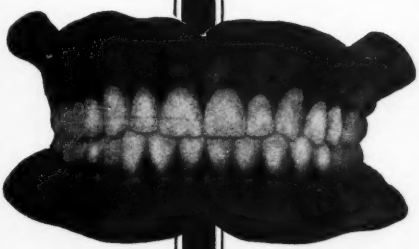
We hope to see you.

BUFFALO DENTAL MFG. CO.
BUFFALO, N. Y.
U. S. A.

DRS CHRISTOPHER AND GOLBECK INC.



Comfortable Fitting



Balanced Articulation

THE use of carefully selected Trubyte teeth and general tooth arrangement, according to Trubyte technique, assures natural appearance.

Dark elastic base rubber with granular pink properly festooned completes the natural restoration.

Particular attention is paid to securing a perfectly balanced articulation so as to give the natural action and comfort which every patient desires.

For prices on these cases see page 47 of our new illustrated combined reference book and revised price list. A copy of this book will be sent on request.

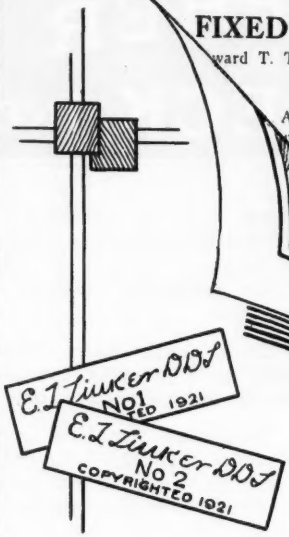
❖ ❖ ❖ ❖

With over 25 years practical experience in oral and prosthetic dentistry at your servite, there is no reason why you cannot greatly increase your practice by availing yourself of the advantages we offer in handling your laboratory work.

We maintain a completely equipped clinical operating room to which you are invited to bring your patients for consultation or for taking impressions, for any cases requiring a special method of procedure. A minimum charge is made for this service.

Mailing boxes, order blanks and crown impression trays sent upon request.

DENTAL LABORATORY SERVICE
Telephones Wabash 2141-2142-2143
339 SOUTH WABASH AVENUE, CHICAGO



FIXED BRIDGEWORK

ward T. Tinker, D.D.S., Minneapolis, Minn.

AND APPLICATION of crown and
both of the fixed and removable type
fascinating in our line of endeavor, and
of dental effort that is accomplished
tisfaction to both the patient and
badly-mistreated mouth infested
ent and restoring the same to
riginal beauty.
is of paramount import-
ge has been done by its
inting results have
mpt at diagnosis
infection and
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TINKER GOLD

EMPLOYING THE PROPER TECHNIQUE AND USING A CASTING GOLD DEVELOPED AND INDICATED FOR THE PURPOSE, PRODUCES CASTINGS AS NEAR PERFECT AS HUMANLY POSSIBLE.

TINKER GOLDS Have Been Indicated For Years

TINKER NO. 1
For full and 3/4 jacket crowns and abutments.
Price .....$1.55 dwt.

TINKER NO. 2
For lower incisors and upper ¾ crowns.
Price .....$1.65 dwt.

TINKER NO. 3
For a strong, thin, cast clasp.
Price .....$2.25 dwt.

TINKER NO. 4
For saddles, overarch and lingual bars.
Price .....$1.50 dwt.

SOLD BY DENTAL DEALERS

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SMELTING & REFINING CO.

51 S. Third St.
MINNEAPOLIS, MINN.

REFINERS OF GOLD—SILVER—PLATINUM
MANUFACTURERS OF GOLD SOLDER—PLATES—WIRE

NOTE: "Fixed Bridgework" by E. T. Tinker, D.D.S., yours for the asking. Distribution through dental dealers.

"Waites is not made with an ordinary salt or Ringer solution."

Also manufacturers of
Waites
DENTAL CREAM
Recommended by Prominent Dentists.

Waites
Antiseptic
Local Anesthetic
In Ampules

"We're not going to make any more anesthetic ourselves," said the dentist to his assistant, "and here's the reason: "This Waite's Antiseptic Local Anesthetic is made on a base of Ortho and Para Mono-Iodo Phenol—something we can't duplicate ourselves."

"This base is both an anesthetic and an antiseptic, and preserves the solution indefinitely. It provides longer, stronger anesthesia than procaine or cocaine alone—and being antiseptic prevents infection and facilitates rapid healing of tissue."

"Besides, it's cheaper to use than to take the time mixing our own, so after this, we'll use Waite's in convenient, hermetically sealed ampules or bottles."

THE ANTIDOLOR MFG. CO.
196 Main Street
Springville, Erie Co., N. Y., U. S. A.
Fort Erie, Ont., Canada

IT is only fair to yourself and your work to *insist* on your patients using a dentifrice that backs up your work. Recommend Waite's because it:—

1. Removes placques, tartar and stains without scratching the enamel.
2. Eliminates hundreds of millions of germs in the mouth.
3. Corrects acid mouth, thereby preventing decay of the teeth.
4. Cleans, polishes and whitens the teeth.
5. Leaves a cool, clean, refreshing effect in the mouth.
6. Makes healthy gums a habit.

You can do no better than to recommend Waite's.

Send for large tube free.

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Springville, Erie Co., N. Y., U. S. A.
Fort Erie, Ont. Paris, France

HEIDBRINK

ADVANTAGE

The Owner of the New "Heidbrink" Model T Has a Big Advantage in

Super-Safety and Super-Control

TO SIMPLIFY gas machine operation is the aim of many new "Heidbrink" improvements. Thus, the new *Selective Emergency Valve* of the latest "Heidbrink"—the Model *T*—gives you greater Safety and quicker emergency Control *by means of a single instantaneous manipulation.*

A SLIGHT TURN OF A SINGLE VALVE GIVES

Pure Oxygen	**Bag shut**
Pure Oxygen	**Bag open**
Pure Nitrous Oxid	**Bag shut**
Pure Nitrous Oxid	**Bag open**
Any Mixture	**Bag open**
Any Mixture	**Bag shut**

And all the above is under pressure limited as desired, by an automatic pressure valve.

"Heidbrink PLUS" is what an expert called the new Model T. And it is—because all the advanced engineering features which won world leadership for these machines are retained in the new: *Control on top—sight feed indication—accurate delivery of a known percentage* of each gas at a *known and indicated rate of flow*—and volumes of *emergency Oxygen.*

A boon to the novice—a joy to the expert—the new Model T leaves nothing more to be desired for safety, for efficiency or for profit.

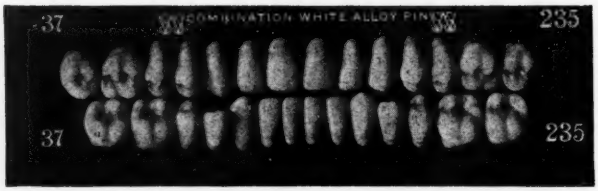
See this greatest of all gas machines before deciding—you'll find reasons enough for desiring it above all others.

Have you seen our new Catalog 6? Write for your copy today.

The HEIDBRINK COMPANY
Minneapolis Minnesota U.S.A.

HI-CO

A Satisfied Customer
The Best Recommendation



A DENTIST who recently visited our factory was more than pleased to see the large quantity of White-Alloy Pin Teeth going through the various processes.

He had used a great many of the Gum Section teeth and complimented them highly—in fact he was disturbed by a rumor that their manufacture had been discontinued.

He had been misinformed; the truth is that the manufacture of White-Alloy Pin Teeth both in Plain Vulcanite and Gum Sections is increasing daily and has been constantly increasing since their introduction.

The satisfied customer is the real reason for the continued growth. This dentist like many others has found White-Alloy Pin Teeth entirely satisfactory.

Porcelain---*Strong and Translucent*
Colors---*Natural and Comprehensive*
Forms---*Practical and Beautiful*
Attachment---*Strong and Durable*

White-Alloy Pin Combination Sets

Set of 14	each	$1.00
In $100.00 lots	per set	.90
Gum Sections (all pin)	set of 14	2.80
In $100.00 lots	per set	2.52

THE S. S. WHITE DENTAL MFG. CO.
"Since 1844 the Standard"
PHILADELPHIA

For Sale by Dealers and Our Houses — Mold Book on Request

GUARANTEED!

Wholly and solely made from chemically pure elementary products which are SYNTHETICALLY compounded together in the "GARHART" LABORATORIES.

SYNTHAY PORCELAIN

REGISTERED U. S. PAT. OFF

"MADE BY N.D. Garhart HIMSELF"

BECAUSE!

After EIGHT years of service in the hands of the rank and file of the profession, there is no better product when compared with all other makes which they have heretofore used in their practice.

Besides the virtue of its very efficient tooth conserving properties is the one of ECONOMY. One package of "Synthay Porcelain" is equal to TWO of most other makes with respect to the QUANTITY contents of the package.

GARHART DENTAL SPECIALTY CO.

Somerville 42, Boston, Mass.

"YES—I remember when August Drucker himself used to visit my office and leave samples of Revelation Tooth Powder. That was years ago. Now I understand it is one of the biggest selling tooth powders in the country. And it's no wonder, either! I got in the habit of using Revelation and of recommending it to patients, and nothing else seems quite as satisfactory after using Revelation."

Across the lunch table another dentist spoke up: "Well, I haven't been in practice as long as you have, so I haven't been using Revelation for as many years. I got started through an advertisement. There *is* something about Revelation that makes you keep on using it and recommending it, isn't there?"

This is part of a conversation which was reported to us recently.

On receipt of *your* card, we will be pleased to send *you* a full-size can of Revelation for test.

AUGUST E. DRUCKER COMPANY
2679 California St. San Francisco, Calif.

REVELATION

for Teeth *and Gums*

NEVER IN PASTE FORM

S. S. WHITE CARD INDEX SYSTEM No. 2
IS SIMPLICITY ITSELF

You enter patient's name, etc., upon a Record Card, and with that card at hand you do the work the patient needs. Then before you put the card in its place among the Buff Guides you enter on it what you have done and the charges.

At the end of the month you send out bills for the month's work, transferring the cards to the Salmon Guides, there to remain until paid in full.

When full payment has been made and credited the card is filed among the Blue Guides to await the next coming of the patient.

Your accounts are thus divided into three classes—

Active (Buff Guides), work under way.
Passive (Salmon Guides), billed, but unpaid.
Closed (Blue Guides), paid in full.

Then there's a Bill Card, on which you enter names and amounts when you send out bills and a Cash Card, to show the cash receipts.

Any time and in a moment you can tell just where and how any patient stands with you.

Suits the largest or smallest practice.

Prices

200 record cards, 3 sets of guides, 25 cash or bill cards, 50 examination blanks No. 3, and follower block, in black japanned tin case with lock and key $13.00
Record Cards separately, per 100 ..... 1.75

Outfit with sterling rule same price

THE S. S. WHITE DENTAL MFG. CO. - Philadelphia
"Since 1844 the Standard"

MEMBERS! Cooperate with your Advertisers

LILLY'S DENTAL PASTE
FORMULA OF J. P. BUCKLEY Ph.G., D.D.S.
PREPARED UNDER AUTHORITY
ELI LILLY & CO. INDIANAPOLIS U.S.A.
DEMONSTRATING SPECIMEN CASE
OF J. P. BUCKLEY'S DENTAL PREPARATIONS
LILLY'S DENTAL PASTE
FORMULA OF J. P. BUCKLEY Ph.G., D.D.S.
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Sixteen Famous Dental Preparations

Formulas of J. P. Buckley, Ph. G., D. D. S.

Only $8.50

This set is sufficient for several month's use in average practice; of certain formulas there is nearly a year's supply.

The young practitioner, with this set, has nearly every needed therapeutic agent, all of the finest quality.

Demonstration size packages are sold only in sets—never singly. To enable dentists to test Lilly Dental Preparations, formulas of Dr. Buckley, we offer the items listed below in demonstration size packages at the low price of $8.50.

ACID PHENOLSULPHONIC, Lilly. Caustic, astringent and antiseptic.

ANALGENTUM, Lilly. An analgesic ointment, stimulating and antiseptic.

DENTAL LINIMENT, Lilly. Local sedative for pericementitis and neuralgic affections.

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EUCALYPTOL COMPOUND, Lilly. Antiseptic.

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EUROFORM PASTE, Lilly. Sedative and mild anesthetic.

FORMOCRESOL, Lilly. Powerful disinfectant for gangrenous pulp.

LOCAL ANESTHETIC SOLUTION No 2, Lilly. (Eight ampoules).
For minor operations.

PROCAINE POINTS, Lilly. Powerful astringent, stimulant and bactericide.

REFRIGERANT COUNTERIRRITANT, Lilly. Counterirritant and sedative.

PHENOL COMPOUND, Lilly. Anodyne, antiseptic and disinfectant.

THYMOLIZED CALCIUM PHOSPHATE, Lilly. A pulp-capping and filling for small root canals.

A pamphlet by Dr. Buckley, giving information on preparations, is included in each set.

SUPPLIED THROUGH THE DENTAL TRADE

ELI LILLY AND COMPANY

INDIANAPOLIS, U. S. A.

IF a brother dentist advised you to use DIOXOGEN in your pyorrhea and pus cases you would probably do so—you would not care just how this advice was worded nor just what he said, but just because it was a brother dentist you would probably follow his advice.

Brother dentists are constantly writing us words of praise about DIOXOGEN—they do not give any reasons why DIOXOGEN is better than anything else they have ever used but they just say it does such good work.

As manufacturers of DIOXOGEN we know why it is so good and will gladly tell you, but what would be more convincing, would be for you to try it for yourself. It's what DIOXOGEN does that interests the dentist and a sample speaks louder than words.

We would send it if we knew your name and address. *Write while it is fresh in your memory.*

THE OAKLAND CHEMICAL CO.
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ECONOMY!

BACON REGULATING APPLIANCES are the most economical for the use of general practitioners because of their good construction and simple operation. A low first cost is poor economy if efficiency is sacrificed to price.

Compare the old carbon filament electric lamp with the tungsten lamp of today. The carbon lamp is cheaper and looks about as good—BUT—it produces only a fraction of the light per unit of electricity and is decidedly more expensive in the long run.

Bacon appliances are superior to other appliances of similar appearance because they are constructed entirely of spring tempered wire and hard solder, affording infinitely greater adaptability, certainty and ease of operation with less bulk. This construction costs more but saves many times the difference during the time of treatment. AND—*the first cost covers all repairs, revisions and criticisms needed throughout the entire case and is offered by no other concern.* Thousands of dentists are our clients. May we not serve you also?

Literature Upon Request

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RESULTS

That Count

Ceramists to the American Dental Profession

When you place an Inlay or Porcelain Jacket Crown in the mouth you are assured of these results:

The satisfaction of knowing your patient has the best possible restoration.

The patient will be pleased.

Your practice will increase.

You can rely on your finished work from these Laboratories being as good as your impressions. Our years of experience in this one line guarantees the Dental Profession positive results.

You will receive courteous treatment and prompt service from our Ceramists of proven ability.

Literature Free

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Better Dentistry

Porcelain Roots or Tips

"Oral Art" Series No. 2

REPRODUCES THE NATURAL TEETH on the lingual as well as the labial and buccal. Result—no lingual concavities.

GINGIVAL ALIGNMENT IS RETAINED, thereby producing the highest esthetic results.

CAST BACKINGS permit change of Shade and Reglazing, also simple to Resolder, as Facings are Removable. Accurate Replacements of broken teeth without removing the Bridge. Write us for technic.

PRICES:

Anteriors, per tooth	*$5.50*
Bicuspids, per tooth	*$6.50*
Molars, per tooth	*$7.50*

Constructed with long pin facings
Cast backings of "T" gold

SUGGESTIONS

Take wax bite and separate impressions of upper and lower with abutments in position. For Balanced Occlusion and the Best Results include many or all of the remaining teeth in your impressions. Send, with shade desired.

Extraction not required until case is completed.

Our Reputation Guarantees You Satisfaction

HENRY P. BOOS
Dental Laboratory
608 Nicollet Ave., Minneapolis, Minn.

Everybody Happy

SO—

Pack up your troubles
In your old kit bag,
And smile, smile, smile

THE DENTIST—
There is no reaching for instruments, engine or controls. Everything at the operator's hand.

THE PATIENT—
The water glass is within reach. The operator doesn't have to reach across patient for instruments.

OFFICE ASSISTANT—
Stream lines and absence of pockets and angles make unit easy to keep clean.

THE PLUMBER—
Finds the pipes easy to connect. There are only two unions.

THE SERVICE MAN—
Finds wires easy to get at and separate from plumbing. Covers removable.

A modern Operating Unit that is as Beautiful as it is Practical

Electro Dental Manufacturing Co.

Philadelphia

New York Chicago Los Angeles

Export Department: 149 Broadway, New York

SUCCESS
IN DENTISTRY

depends upon

PROFESSIONAL ABILITY

CORRECT BUSINESS METHODS

MODERN EQUIPMENT

If it's Ritter — it's Right

Ritter Equipment is Modern Years after the Purchase Price Has Been Forgotten

RITTER

Dental Equipment

RITTER DENTAL MANUFACTURING COMPANY
INCORPORATED
ROCHESTER, N. Y.

SQUIBB'S
DENTAL CREAM
Made with Squibb's Milk of Magnesia

Its Antacid Strength

ONE gram (about 15 grains) of Squibb's Dental Cream will neutralize the acid in—

141 CC (about 4⅔ fluid ounces) of saliva of a pH of 6.4
156 CC (about 5¼ fluid ounces) of saliva of a pH of 6.6
312 CC (about 10½ fluid ounces) of saliva of a pH of 6.8

One gram of Squibb's Dental Cream approximates the usual amount placed upon the tooth brush.

Milk of magnesia, while it has a high affinity for acids, is very slightly soluble, and will thus sustain a mildly alkaline level in the saliva for eight or ten times as long as dentifrices which do not contain milk of magnesia.

There is, therefore, a much greater period of time for its permeation into the remote places and incipient cavities.

When forced into the pits and crevices by the brush, its antacid effects are extended over a period of several hours. Its fullest benefit is attained by not rinsing the mouth too thoroughly after its use.

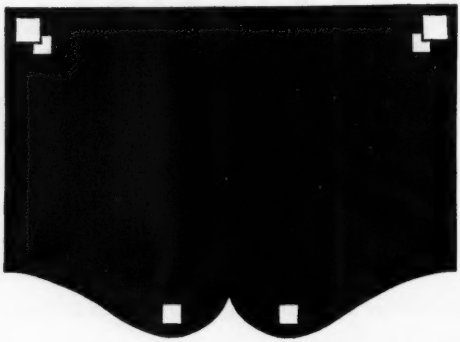
The safe cleansing of teeth and neutralization of acidity is the heart of the dentifrice problem.

Send your card for a complimentary package.

Dental Department, E. R. SQUIBB & SONS, NEW YORK, N. Y.

THE "PRICELESS INGREDIENT" OF EVERY PRODUCT
IS THE HONOR AND INTEGRITY OF ITS MAKER

WHAT'S GOING ON
IN THIS PICTURE?



WHO KNOWS?—ALMOST ANYTHING
Might be happening, but nobody could tell unless some Light were thrown upon the scene

How can you tell, Doctor, what kind of a cavity preparation you are making—what kind of a margin you are getting on your wax pattern—how you are packing that amalgam—unless you have *enough* of the *right kind* of *Light* on your *work.*

WHAT IS THE RIGHT KIND OF A DENTAL LIGHT?

Let us tell you why we think the answer to the question is

THE PATTERSON DENTAL LIGHT

The M. F. Patterson Dental Supply Co.

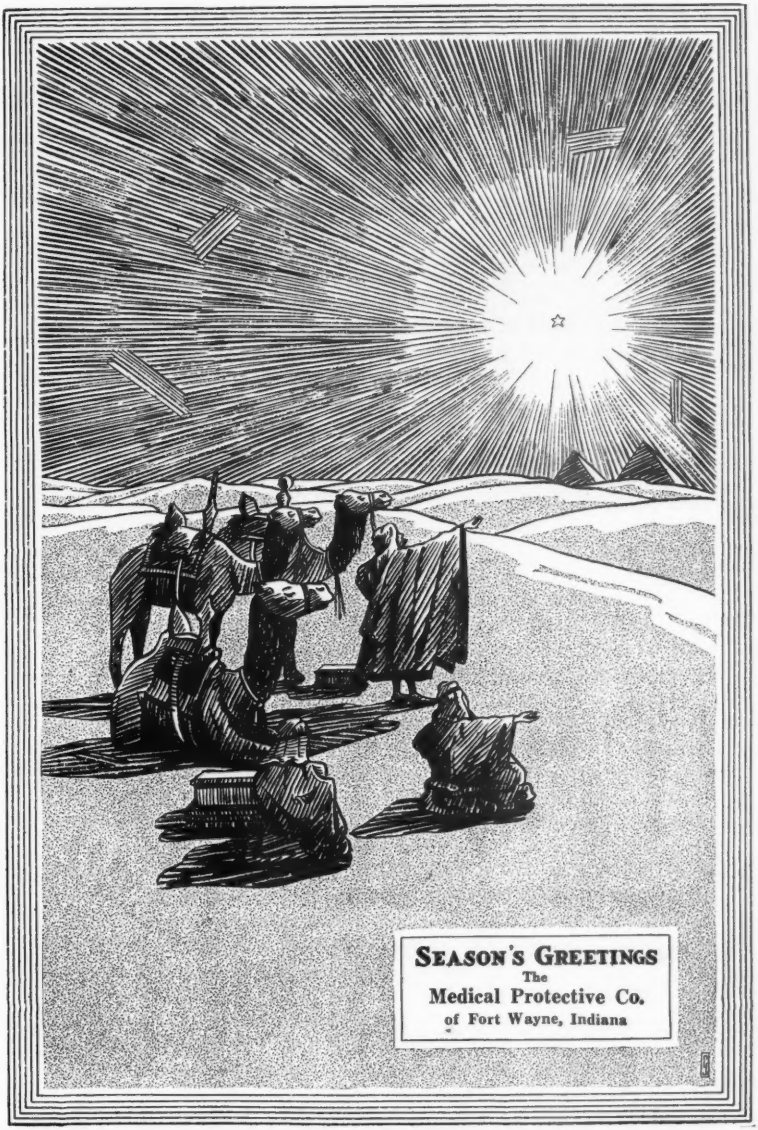
M. F. PATTERSON DENTAL SUPPLY CO.,
406—6th Ave., South, Minneapolis, Minnesota

Please send me your descriptive literature on the
PATTERSON DENTAL LIGHT

Dr. .....

Address .....

City ..... State .....


SEASON'S GREETINGS
The
Medical Protective Co.
of Fort Wayne, Indiana

Testimony:—

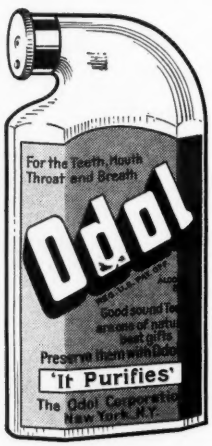
"ITS neutral reaction distinguishes Odol. In consequence of this neutral reaction, an injurious effect upon the salts of lime contained in the teeth is impossible. The antiseptic qualities have been shown by bacteriological tests to be very marked, and such that Odol is as effective as the best acid antiseptic tooth remedies, which contain, for example, benzoic acid, saccharin, or salicylic acid. But acid remedies are inferior to the neutral Odol, inasmuch as the substance of the teeth must be attacked by the acid, as has been directly demonstrated by comparative experiments."

From an article by Professor Huffe of the University of Prague in the "British Journal of Dental Science."

For the Teeth, Mouth, Throat and Breath

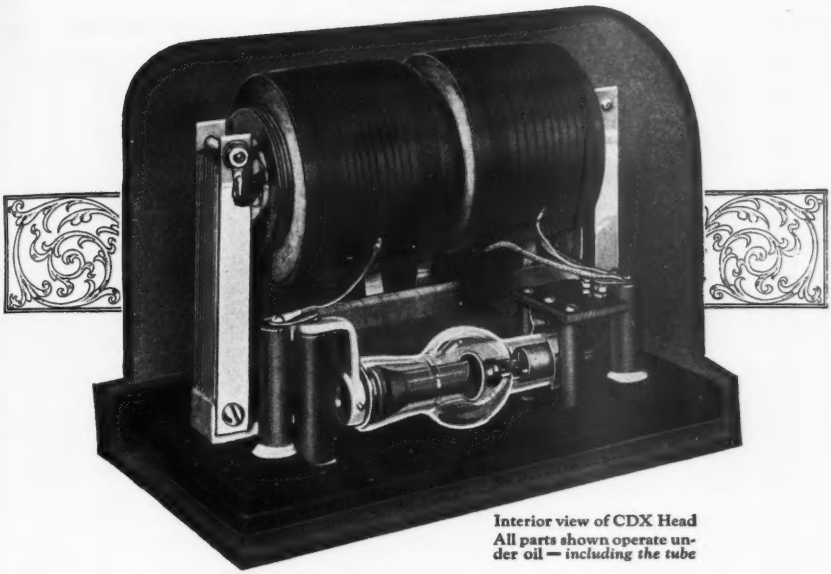
Odol

There's power in every drop



We will gladly send you, on request, sufficient ODOL for your office needs

THE ODOL CORPORATION
389 FIFTH AVENUE, NEW YORK



Interior view of CDX Head
All parts shown operate under oil — *including the tube*

Included in Underwriters list of Inspected Electrical Appliances

CDX— an X-Ray Unit for Dentists

45,000 volts at tube terminals
10 milliampere capacity
No exposed high or low tension wires
100% Electrically safe
Stabilized milliamperage
Finer radiographic detail

Its exceptional convenience and safety invariably encourage more frequent use of the X-ray in daily practice.

Send for the CDX catalog giving full details

VICTOR X-RAY CORPORATION
Dental Department **2012 Jackson Blvd., Chicago**

VICTOR

Looks Like Gold *Wears Like Steel*

Dirigold

Introducing

The New Golden Dental Dirigold Spatula

SOLID METAL — NOT PLATED — NON-CORROSIVE

The Dirigold Spatula

is the first instrument introduced of a line of dental instruments to be manufactured later.

These are manufactured from Dirigold, the Metal with the color of Gold, and the Strength of Steel. Hardened and tempered like steel.

Dirigold is not an amalgamation of metals, but a metal in which the original ingredients, through a chemical reaction, lose their original identity and quality and form an entirely new metal.

Testimonials from prominent Dentists:

"Allow me to express my appreciation and the complete satisfaction I have had in the use of the Dirigold Cement Spatula. It is unaffected by any of the cement liquids and maintains its bright appearance constantly, being also of a convenient shape to manipulate easily. May I wish you every success with this product."

"They are stronger and have all advantages of the best Spatulas on the market, but none of the disadvantages."

"My lady patients exclaim: Such beautiful instruments!"

Order your Dental Spatula through your Dealer

Beautiful folder describing this Spatula will be mailed to you upon your request.

THE DIRIGOLD CORPORATION
Suite 723, Metropolitan Bank Bldg.
MINNEAPOLIS, MINNESOTA

WILSON'S

CO-RE-GA

The Perfect Powder for Dentures

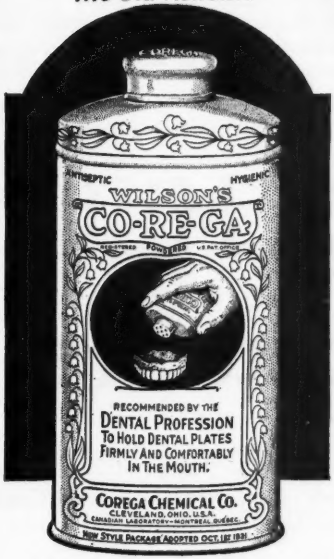
A Small Can Should Go With Each New Plate

A WONDERFUL POWDER TO ASSIST PATIENTS WITH THEIR NEW DENTURES

35¢, 60¢ and $1.00 Sizes

from your Supply House or Druggist

"The Old Reliable"


ANTISEPTIC
HYGIENIC
WILSON'S
CO-RE-GA
RECOMMENDED BY THE DENTAL PROFESSION TO HOLD DENTAL PLATES FIRMLY AND COMFORTABLY IN THE MOUTH.
COREGA CHEMICAL CO.
CLEVELAND, OHIO, U.S.A.
NEW STYLE PACKAGE ADOPTED OCT. 1ST 1931

TEAR OFF COUPON AND MAIL IT —NOW— FOR A GENEROUS SUPPLY OF TRIAL CANS GRATIS

Dr.

COREGA CHEMICAL CO. CLEVELAND, OHIO OR MONTREAL CAN.

The Prophylaxis of Dental Caries

The Cause of Dental Decay: The presence in the mouth of lactic and butyric acids formed by bacterial action on food particles.

The Results of Dental Decay: Roughening, softening and penetration of the enamel; damage to the dentine; the formation of cavities affording lodgment for pathogenic organisms, with subsequent development of root abscesses, gingivitis, pyorrhea, etc.

How to Prevent Dental Decay: The daily, systematic application of a suitable, non-irritating, non-abrasive alkaline fluid is the best and most practical method of controlling or preventing dental decay. This is not an empty assertion, but it has the support of authority.

Note. Thousands of your fellow-practitioners have made the discovery that "Phillips' Milk of Magnesia" is just such a fluid. It completely fills the bill. It is the ideal alkalinizer for use in the human mouth.

WHY YOU SHOULD SPECIFY "PHILLIP'S MILK OF MAGNESIA"

a. It is pure, i. e., free from every trace of deleterious substances.

b. It is a hydrate and, therefore, has a special affinity for acids.

c. It acts immediately and efficiently, and has no disagreeable effects.

d. It is three times as efficient as bicarbonate of sodium and *fifty times* as powerful as lime water in neutralizing acids.

HOW TO USE "PHILLIP'S MILK OF MAGNESIA"

Kindly instruct your patients to rinse the mouth with a tablespoonful of "Phillips' Milk of Magnesia," at least twice a day, and invariably at bed-time, as acidity is most likely to develop during sleep.

The nightly application should be made in the following way: Cleanse the teeth well with a toothbrush and warm water. Rinse the mouth thoroughly, then take a tablespoonful of "Phillips' Milk of Magnesia" and work it back and forth through the spaces between the teeth for a few moments—the object being to reach every surface of all the teeth. After rejecting the superfluous portion *do not rinse the mouth again, but allow the alkaline film of Magnesia to remain on the dental surfaces.*

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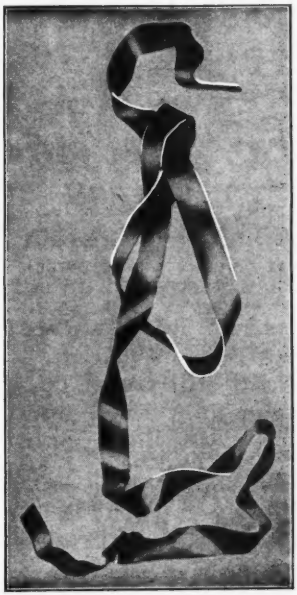

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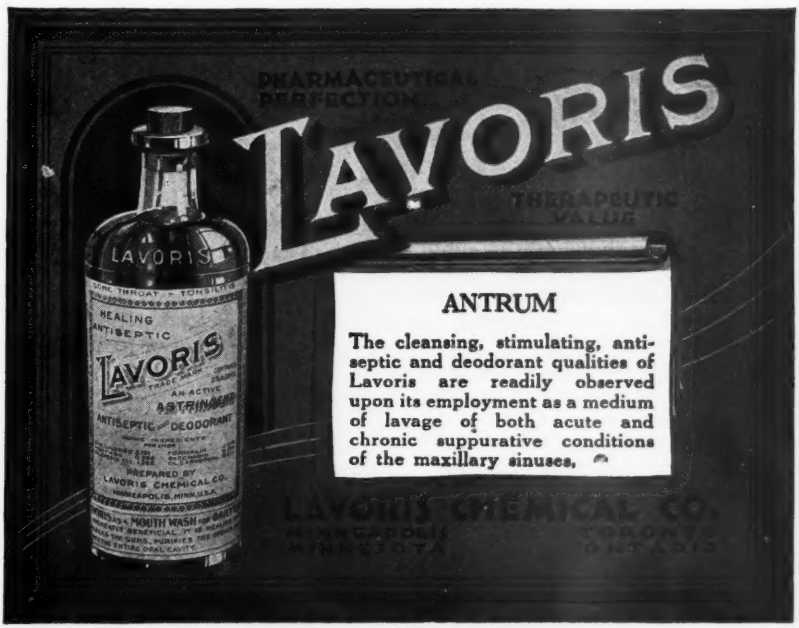
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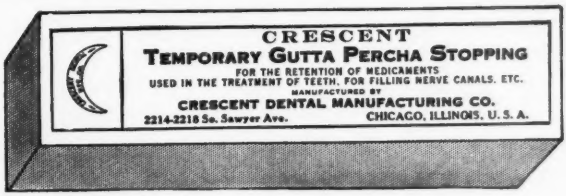
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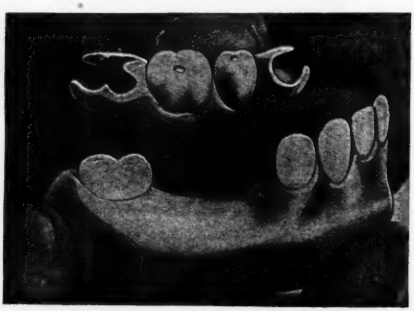

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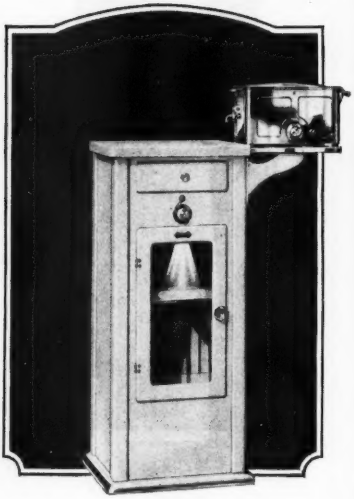

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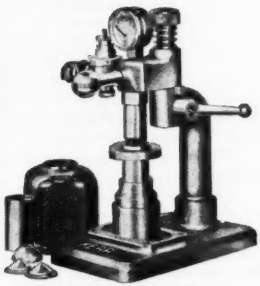

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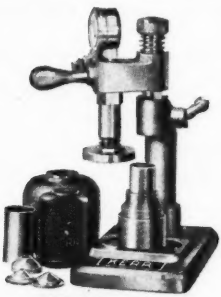

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Published Monthly.

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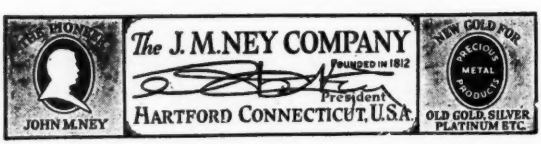

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